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This incident is an illustration of the most important characteristic of the modern radical movement—a characteristic which expresses the very essence of the movement. It is a movement, not so much to create new institutions, industrial or political, as to tear down existing ones; a movement not so much to enrich the poor as to impoverish the rich; a movement based not so much on solicitude for the masses as on envy of the classes; a movement not so much to "socialize" property as to destroy the private ownership of it, even though incidentally the property itself be destroyed. The only country in which the movement has been entirely triumphant is Russia, and there the destruction not only of the private ownership of property but of property itself has been so great that while the rich have been made poor the poor have been largely frozen and starved to death. The American people cannot too early become fully alive to the purely negative and destructive character of the radical movement. The prosperity and progress of the human race have been promoted, not by those who have been dominated by the instinct of destruction, but by those whose instincts have been chiefly or wholly constructive.

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THE VIRGINIAN RAILWAY adopted a few months ago, a new book of rules for the operating department, which deserves mention for the numerous examples of felicitous language with which its pages are sprinkled. The officers of the road, no doubt, will look with amusement, if not with mild contempt, on the critic who gives attention first to language instead of to practice; to form instead of substance; but "there is a reason." Rule-book makers have to expend most of their energies on the form of the words. That is the element in which they can do good work and make real improvement, and improvements in language constitute the feature for which they deserve credit. Changes in the substance of the rule, on the other hand, are subject to varied dangers comparable to lightning, earthquake and other cataclysmic disturbances. For example, Rule 93, in this book, requires *all* trains to run under control within yard limits, a simplification of practice in the interest of safety which would seem at least to deserve a thorough trial; but the new rule had hardly got started before it was knocked off its pedestal; it was modified, as regards passenger trains, within a few weeks after the new code went into effect.

Rule 4 (for changing time tables) is another in which practice and language do not "function" together with any success. Innumerable conferences have used up reams of paper in rewriting this rule, and one man has written a book about it; but differences concerning its language do not seem likely to be settled in the present age. This is one of the points where all the code makers combined have failed to achieve a success. The Virginian's book settles the question in the only way that is both simple and practicable; it says that when a time-table expires all trains lose all rights. To the old-school despatcher it seems, no doubt, like sacrilege thus to cast aside the work of scores of minds through scores of years; but there is no real cause for their surprise; the simplified rule, after all, is no more radical a simplification than is the block system; and the block system is now familiar to everybody.

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The simplification of Rule 4, as exemplified in this book, is also desirable and commendable for the same general reason. The abolition of the complicated form of the rule helps the despatchers to recognize more fully in practice the block system principle of always giving trains absolute right to definite points. We have heard of cases where conductors and enginemen actually have lain off, when a new time table went into effect, because of their dread of problems which they would encounter in the transition from the old table to the new one, under the longer form of Rule 4.

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as to just what the superintendent is calling for when he tells them to "observe the conduct" of passengers; but there is much valuable suggestion in the variety of expression here presented. And if there are numerous new words in this book which need to be defined, the author will still be in good company; the same need will be found in rules of the best roads.*

As was intimated at the outset, the language of trainmen's rules everywhere is susceptible of decided improvement, and the wideawake operating officer will, of course, embrace every opportunity, such as the appearance of a new book, to re-examine the good and bad features of his own rules. The American Railway Association when, years ago, it laid on the table (or, rather, consigned to the garret) the excellent matter presented by its committee as an enlargement of the standard code, deferred a useful and needed improvement. The fact that these rules have lain buried in the dust for 20 years does not alter their value. Good rules do not insure good practice; neither is uniformity in language a satisfactory substitute for precision and clarity. The present argument is not intended to encourage the superintendent who depends on a book to enforce obedience, nor to support any Congressional bill to establish a uniform code throughout the United States; but the duty of greatly improving our rule books is exceedingly plain to every one who examines the subject with discrimination and care.

Continue Fuel Conservation Measures

THE WORK of the Fuel Conservation Section of the United States Railroad Administration may soon be brought to an end by the return of the railroads to private operation, and a brief survey of the results which have been accomplished is not out of place in relation to the future of the fuel conservation movement on the railroads.

At the beginning of its organization the Railroad Administration was confronted with a serious fuel problem. The production of coal had been greatly reduced by the extraordinarily severe winter of 1917 and 1918, and the demand for coal in 1918 gave promise of materially exceeding the supply. Aside from the necessity for conserving the available supply of fuel, the efforts at increased production had led to a heavy increase in the amount of non-combustible material in the coal, which also needed attention if the railways were effectively to meet the transportation demands of the country. The latter problem was the first to be taken up by the Fuel Conservation Section following its official birth on May 1, 1918. This part of its work was conducted largely through the fuel inspectors of the various railroads and in co-operation with the Fuel Administration.

In its efforts toward the reduction of coal consumption the Fuel Conservation Section has acted largely as a clearing house of proved practices and a source of inspiration to those needing it. As well established as the fuel department had become on some railroads during the decade prior to government control, there were a large number of roads on which no special attention had been given to the fuel problem. Many of these roads have been induced to establish strong organizations for the supervision of the distribution and consumption of the road's fuel supplies and on other roads, although distinct fuel organizations have not been established, more adequate supervision of locomotive operation has been provided, making it possible to give more attention to fuel matters. To the credit of the Fuel Conservation Section it must be said that in all its work no serious antagonism has been aroused, while a vast amount of whole-hearted co-operation has been inspired even where managements were loath to go as far as the importance of the problem of fuel conservation justifies.

The concrete result of this work is reflected in the figures of locomotive performance for the first nine months of 1919 which, making due allowance for differences in traffic handled, show a saving of 8.4 per cent in freight service and 8.3 per cent in passenger service, when compared with the same period of the previous year. For both classes of service this is a saving of $32,051,312 over the same period of the preceeding year. That this cannot be attributed entirely to the extraordinary conditions existing during the early months of 1918, is evident from the fact that for the three months of July, August and September of 1919, a saving of 5.3 per cent in freight service and 3.7 per cent in passenger service are shown as compared with the same period of 1918, making a total saving for both classes of service of $4,238,021.

It is highly desirable that such results be continued. During the year 1917 alone the average value per net ton of bituminous coal at the mine increased 94 per cent in the United States, while fuel for locomotive use alone increased from 10.3 per cent of all operating expenses in 1916 to 13.9 per cent in 1917, or from $984 to $1,697 per mile of line, and these figures do not take into account the further increase in the price of coal which has taken place since the removal of the price control exercised by the Fuel Administration during 1917-18.

It will probably not be practicable to maintain a permanent central organization or national supervision of fuel conservation after the roads return to private operation. With the economic soundness of such a course so well demonstrated, however, there is no reason why fuel supervision should not be established under strong staff control on every railroad of importance in the country and the departments already established be effectively maintained.

Coal is a bulky commodity which does not lend itself to the same care in handling as is readily exercised with most of the other materials used by the railroads. The quantity in which it is used and the ease with which it may be wasted without detection demands a degree of supervision to insure that it is not wasted in the several hands through which it must pass from the mine to the firebox, which need be given to no other material. With these facts and the results obtained during the war in mind, the magnitude of the coal bill is ample warrant for the expectation of a large return for the comparatively small cost of maintaining an effective organization for conserving the fuel supply.

*EXTRACTS FROM VIRGINIAN RAILWAY RULE BOOK.

525. . . . The proper place for flagman of a passenger train making an unusual stop in yard limits or remaining to exceed three minutes at a regular stop within yard limits is at rear of train, on ground, with flagging equipment ready to act in any emergency.

526. No passenger trainman should report for duty unless neat in appearance, uniform clean and neatly pressed, clean shaven, clean linen, and shoes polished. There should be no incongruity in dress and no unnecessary adornment.

527. Brakemen should station themselves at the point at which passengers will board or leave the train, to render any assistance that may be required. In no case must they lounge or stroll about the platform or cling to the handrailing of the cars for support, but maintain an erect attitude, alert and watchful. It is bad taste for a man in uniform to thrust his hands into his pockets, keeping them there.

528. After leaving stations, they should notice whether or not persons are hanging to sides of cars unable to enter on account of closed vestibules, and if so, go immediately to their assistance.

529. Under no circumstances should passenger trainmen engage in unnecessary conversation with each other or with passengers, at stations, or on trains. To do so will sooner or later result in their overlooking some important duty. Necessary conversations of a business character should be conducted in a dignified and respectful manner, with never-failing courtesy.

530. Passenger trainmen are required to exert themselves constantly to see after the comfort of passengers. However, care should be taken not to render themselves objectionable to particularly sensitive people.

534. Passenger trainmen should refrain from reading on duty or congregating in the same car. They should pass through the cars frequently, looking after the wants of passengers and observe their conduct, seeing that none are engaged in anything that might be offensive to others or violation of rules.

538. The announcing of stations must be done in a CLEAR and DISTINCT tone of voice and not less than twice in each coach, and in such a manner as that each person in the car can hear the name of the station, except such as may be deaf, who are entitled to special attention. This announcement should be made with closed doors approaching the station and at such a time as that the roar of the train or the whistle of the engine will not prevent the announcement being disinctly heard. Brakemen should, as far as practicable, learn the destination of passengers and assist the conductor in preventing their being carried by their destinations.

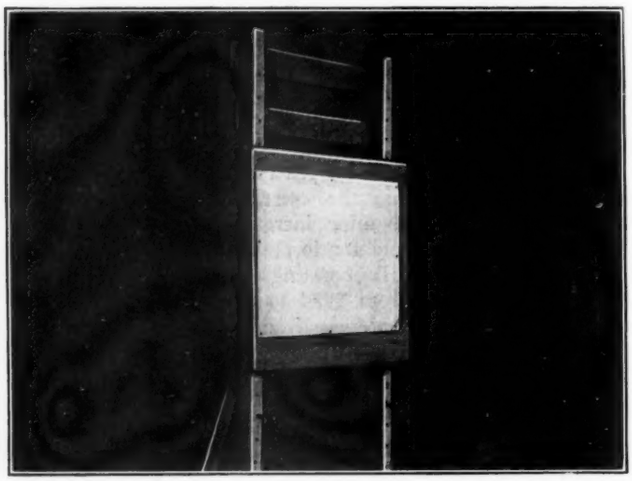
Deflections of Staybolts in Locomotive Boilers

Relative Action of Rigid and Flexible Staybolts and the Sheets of Locomotive Fireboxes

By George L. Fowler

For many years the breakage of staybolts in locomotive boilers has been a source of danger and this danger was emphasized very soon after the locomotive took its rapid leap ahead in size when it was found that it was no longer necessary to limit firebox dimensions to the space available between the driving axles and the frames.

The increase in the length of fireboxes caused a corresponding increase in staybolt breakages. It was assumed that this breakage was caused by the bending of the staybolts due to a variation in the expansion of the two sheets which they connected, by which they were strained beyond their elastic



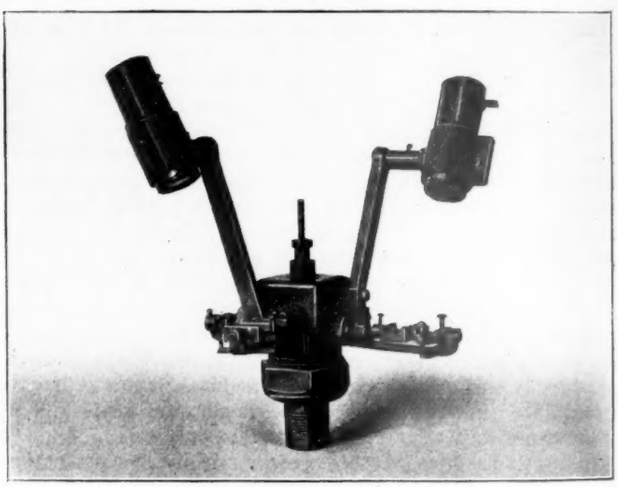
Screen for Recording the Movement of the Beams of Light Reflected by the Mirrors

limits, thus producing a progressive fracture. It was also assumed when the boiler was working under normal conditions that staybolts were straight in their normal position and were subjected only to that stress which would be imposed upon them by the steam pressure acting upon the plates. It was further assumed that the deflection of the bolts occurred during the process of raising steam, and that, because the breakage occurred at the ends of the firebox, there was a neutral vertical zone at the longitudinal center of the firebox along which there was no staybolt deflection. But, while assumptions and theories were as plentiful as autumn leaves, there was no data on the subject and no one knew. The most that had been done, in the way of investigation, was to determine that, under certain conditions, there was an upward and downward movement of the crown-sheet and the tubes.

The object of the investigation described in this article was to determine, by actual measurement, the amount of relative movement between the inner and outer sheets of a locomotive firebox and also when that motion occurred as well as its general character. There was no precedent upon which to proceed nor any thing more than the vaguest of guesses as to the amount of motion to be looked for—except that probably it would be very slight.

The apparatus used was of a very simple character and involved only one moving part. Its work consisted of resolving the motion of the inner sheet relatively to the outer one, into its vertical and horizontal components and projecting them on a screen. These were afterwards recombined to plot this relative movement in the form of a diagram. The mechanism of the apparatus consisted of two small metallic mirrors that were first adjusted to a perfect parallel. A beam of light from a narrow slit was reflected back to a screen. One mirror was fastened rigidly to the outer sheet and traveled with it and remained parallel to it at all times. The main body of the apparatus including all lenses and adjustments was also attached to this same sheet. The second mirror was suspended on the main body of the apparatus but was so connected to the inner sheet that, if any motion took place between the two sheets, the mirror would be rotated. This would cause a separation of the two beams of light on the screen and the amount of separation was a measure of the relative movement of the sheets. The calculation of the motion was simply dependent upon the distance at which the screen was set from the mirrors.

The first setting was such that separation of 1/16 in. indicated a relative movement of 1/20,000 in. between the two plates. This was found to give finer measurements than were needed and the whole of the work, hereinafter detailed, was done with the screen so set that each 1/16 in. separation



The Original Apparatus

of the beams of light indicated a relative movement of 1/6400 in. between the plates.

The first boilers subjected to investigation were of the radial stayed type as illustrated in the accompanying engravings. There were two of them that were identical in construction except that one was fitted with a complete installation of the ordinary rigid staybolts and the other with a complete installation of the Tate flexible staybolts.

The firebox dimensions were:

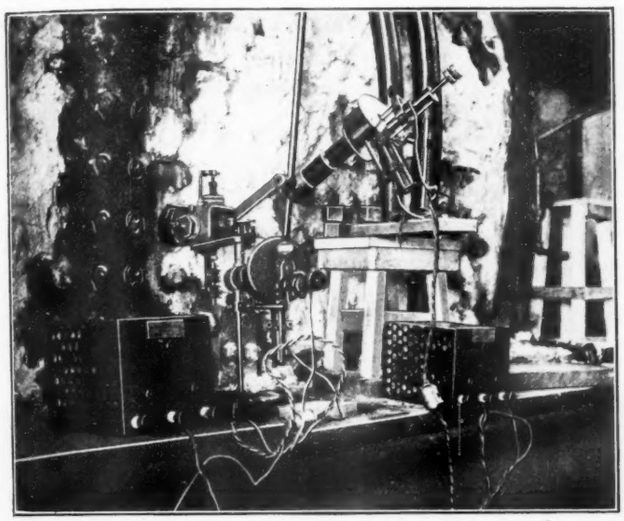
Length at bottom	8 ft. 3 in.
Length at top	8 ft. 8½ in.
Width at bottom	5 ft. 2 in.
Width at top	4 ft. 8 in.

The general arrangement of the apparatus is shown in the illustrations. Each firebox was fitted with four water tubes for carrying a brick arch which was located as shown.

New fireboxes had been placed in each of the boilers immediately prior to the tests so that all of the sheets affected were fresh and clean.

Scope of Investigation

The scope of the investigation was as follows: Determination of the difference in the movement of the inner and outer side sheets of the firebox at eight points; the difference in movement of the crownsheet relatively to the roofsheet; of the back firebox sheet relatively to the back head; of the throat sheet relatively to the front tubesheet and of the front tubesheet relatively to the shell. Determination of the temperature of the fire and water sides of the inner firebox sheet at the side at five points; the water temperatures in the



The Original Apparatus Applied to a Radially Stayed Boiler

throat at the foundation ring and in front of the arch tube openings, while steam was being raised in the boiler and while it was at work.

Two methods of conducting the tests were employed. In one the fire was kindled and the fireman instructed to raise steam in the manner usual in regular roundhouse work. When the safety valve opened, the fire was maintained so as to keep the valve blowing for from 10 to 20 minutes, when the fire was dumped and the boiler allowed to cool. The time required to raise the steam pressure to the blowing off point varied from 50 to 90 minutes.

The second method was the same as the first insofar as the raising of steam pressure is concerned; but, when this was done, the distribution valves having been removed from the locomotive, the throttle was opened and, with the injector running to capacity, the fire was maintained so as to hold the steam pressure at the blowing-off point—195 lb.—for about 30 minutes and then the fire was dumped and the boiler cooled.

In raising steam the shop blower, carrying a pressure of about 60 lb. per sq. in., was attached to the locomotive and used until the boiler pressure reached that amount, after which the regular locomotive blowers were used.

In cooling the boiler steam was blown out so as to cause a fall of pressure of about 1 lb. per min., taking about three hours to reduce the pressure to zero.

In making the tests the apparatus was successively located at the staybolts marked 1, 2, 3, 4, 5, 6, 7 and 8.

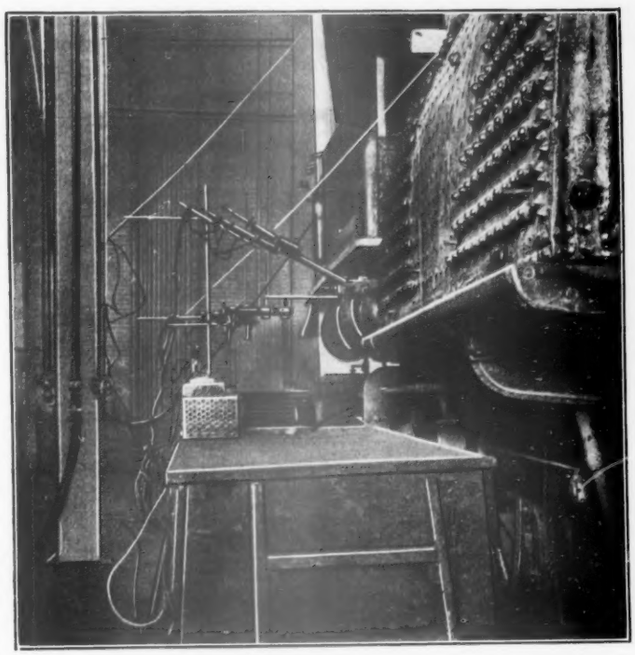
Lack of space will make it impossible to enter into the details of all of the work done, and only enough of it will be described to give an idea of what was learned and the basis for the tentative conclusions that have been reached. I say "tentative" because the investigation has not yet been completed and full information is not available as to how all kinds of fireboxes act in service. The reasons for this will appear as the description proceeds.

In the tests at staybolt No. 1, which was at the front upper corner of the firebox, the first method of testing was used, and the results obtained are shown in the diagram. In this, as in all diagrams to follow, the scale of movement is in thousandths of an inch, on either side, vertically or horizontally, of the starting point at O which denotes the normal position of the two sheets when the boiler was cold at the commencement of the test.

In the first test at staybolt No. 1, it will be noticed that the initial movement of the inner sheet relatively to the outer one was downward and to the rear, and it will be seen later that this initial downward movement was characteristic of nearly all of the tests. Both the downward and rearward movements were, however, quickly reversed and the inner sheet moved up and to the front.

There are features brought out in this diagram that are characteristic of all of the others and to which attention may be called here. One is that the sheets do not expand and return to their normal position when a steam pressure is raised; a second that the sheets are in constant motion relatively to each other at all times, and that the relative motion is much greater with a boiler fitted with flexible stays than it is with one having rigid stays.

In the case of staybolt No. 1, this difference in movement



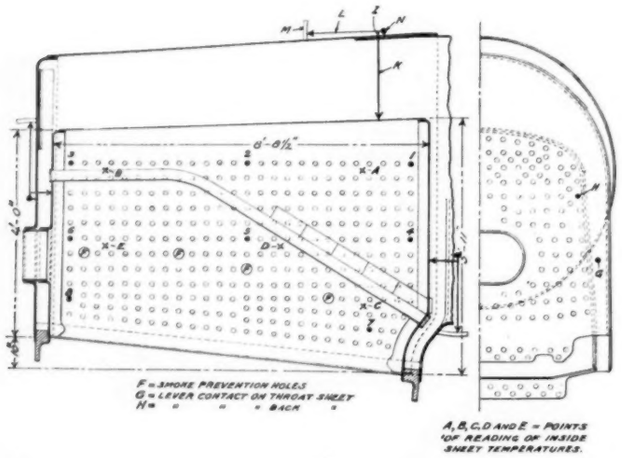
The Redesigned Apparatus Applied to a Boiler Having a Wootten Firebox

is very marked and the total maximum deflection of the flexibly stayed boiler is more than twice that of the rigidly stayed. If the variation of vertical movement alone is taken into consideration, that of the flexibly stayed boiler is more than five times as great as that of the rigidly stayed. It will be seen, too, that there is a general progressive movement until the blowing-off pressure is reached, then, while that is being maintained, there was a movement of the sheets to and fro, with a general return movement towards the original normal position after the fire was dumped and until the boiler had been cooled to the disappearance of all pressure.

In this first diagram, the rigidly stayed sheet returned to within about .001 in. of its original position, while the

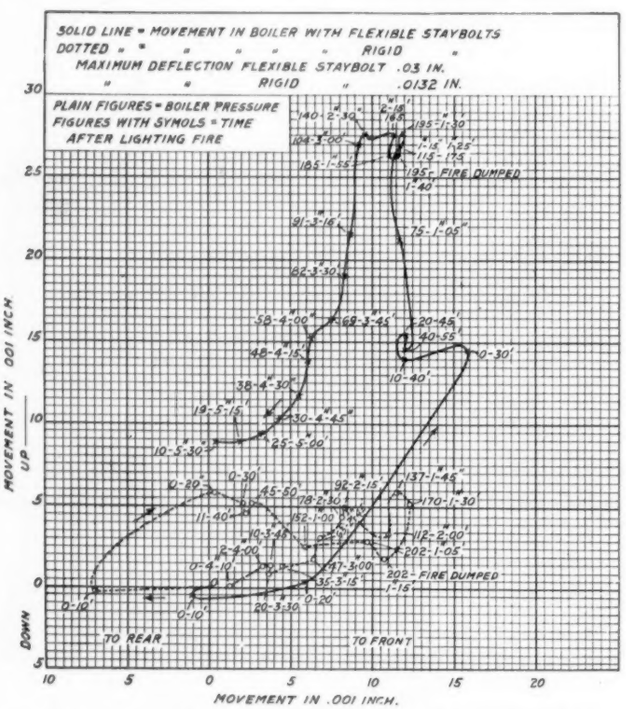
flexibly stayed sheet was out about .009 in. at the conclusion of the test.

Owing to the fact that, in rigidly stayed boilers, the breakage at the upper front and back corners of the side sheet was much greater than it was midway between the two, it has been assumed that there was a neutral point on this midway


F = SMOKE PREVENTION HOLES
G = LEVER CONTACT ON THROAT SHEET
H = " " " BACK "
A, B, C, D AND E = POINTS OF READING OF INSIDE SHEET TEMPERATURES.

Arrangement of Firebox in Lake Shore Michigan Southern Locomotive for Temperature and Expansion Tests

line, on which the staybolt deflection was little or nothing. That this surmise was approximately correct is shown by the diagram of the tests made at staybolt No. 2 which was at the center of the upper row. Here, in both the flexibly and rigidly stayed boiler, we find that the horizontal motion was


SOLID LINE = MOVEMENT IN BOILER WITH FLEXIBLE STAYBOLTS
DOTTED " " " " " RIGID "
MAXIMUM DEFLECTION FLEXIBLE STAYBOLT .03 IN.
" " RIGID " .0132 IN.
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMOLS = TIME
AFTER LIGHTING FIRE
MOVEMENT IN .001 INCH
UP
DOWN
TO REAR
TO FRONT
MOVEMENT IN .001 INCH.

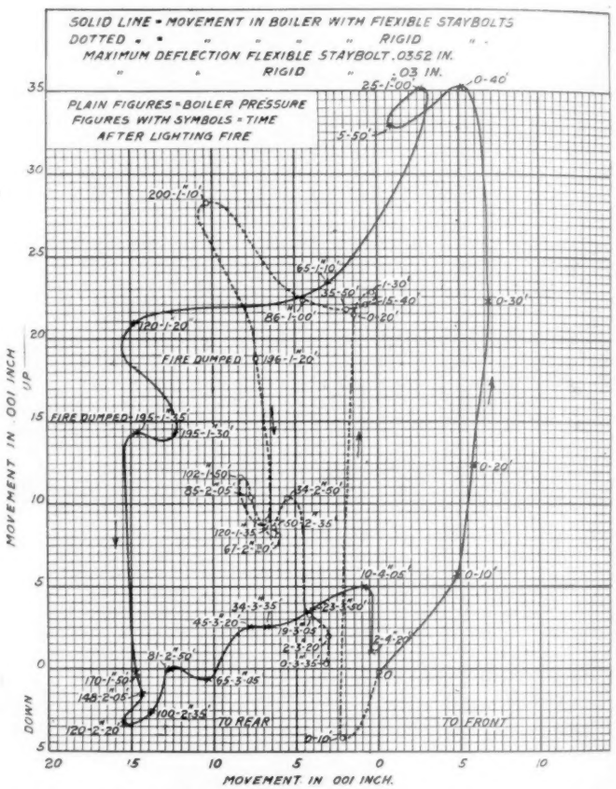
Staybolt No. 1 Top Row Front—Lake Shore & Michigan Southern Locomotive

much less than the vertical, indicating an approach to a neutral zone, but, as at staybolt No. 1, we find the horizontal movement of the sheet to be something more than twice as much on the flexible as on the rigidly stayed boiler.

It is impossible to state positively that there is no neutral line with the rigid boiler, but the statement can be made regarding the flexibly stayed boiler. Of course, if the front end of the inner sheet goes to the front and the back end to the rear there is, possibly, an instantaneous neutral line, but it must be in constant motion and, therefore, does not fulfil the preconceived ideas as to the neutral line.

From a study of the curves of movement of the staybolts examined on the rigidly stayed boiler, the evidence is that the same holds true for that boiler, namely, that the point of no movement—that is, where the two sheets occupy their original or normal positions—is in constant motion. This means that all staybolts are being constantly bent back and forth, which is corroborated by the determination of sheet temperatures which formed a part of this investigation.

In the case of staybolt No. 3, which was at the back end


SOLID LINE = MOVEMENT IN BOILER WITH FIEXIBLE STAYBOLTS
DOTTED " " " " " RIGID "
MAXIMUM DEFLECTION FLEXIBLE STAYBOLT .0352 IN.
" " RIGID " .03 IN.
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMBOLS = TIME
AFTER LIGHTING FIRE
FIRE DUMPED
MOVEMENT IN .001 INCH
UP
DOWN
TO REAR
TO FRONT
MOVEMENT IN 001 INCH.

Staybolt No. 2 Top Row Center—Lake Shore & Michigan Southern

of the top row and close to the back head, there was a sudden and rapid movement of the inner sheet to the rear on both rigidly and flexibly stayed boilers, and the maximum of the horizontal movement was reached in a very short time after the kindling of the fire; the rigidly stayed boiler reaching it in 10 and the flexibly stayed in 20 minutes.

Without going into details of the other tests, it may be stated that while the amount of movement varied, the character of the motion did not vary essentially and the same relationship between the rigidly and the flexibly stayed boilers was maintained.

When tests were made at the next to the bottom row of staybolts, however, a matter developed that proved to be of very great importance. Attention has already been called to the fact that in the test at staybolt No. 1, the first apparent motion of the sheet was downward, but as this only amounted to .00075 in. it was regarded as a negligible quantity. At the bolt below it, (No. 4,) there was a drop of .00225 in. which was still not enough to excite suspicion, but at No. 7 this drop increased to .009 in., apparently indicating a downward movement of the inner sheet at a point

only a few inches above where it was riveted to the mud ring. Evidently this is an impossibility, and the only explanation to be made was that the sheet had buckled and, by throwing the apparatus out of line, caused it to indicate a downward movement.

These first tests therefore must be regarded as showing but two things: the constant movement of the staybolts while in service and the relative movement of the sheets of a rigidly and flexibly stayed boiler.

With no precedent to serve as guide, the apparatus had been designed on the assumption that the two sheets would remain parallel to each other at all times. When this evident buckling was discovered the apparatus was redesigned so as to indicate not only the movement of the sheets but any buckling that might take place.

This redesigned apparatus was used on some boilers having a Wootten firebox with general dimensions as follows:

Length	10 ft. 1 in.
Width at foundation ring	8 ft. 11¾ in.
Height at front	5 ft. 8 in.
Height at back	5 ft. 1½ in.
Depth of combustion chamber	5¼ in.
Number of 2 in. tubes	411
Length of tubes	14 ft. 6 in.
Inside diameter of shell (front)	6 ft. 1 in.
Height of roof over crown (front)	1 ft. 6¾ in.
Height of roof over crown (rear)	1 ft. 9½ in.

There were three rows of expansion stays at the front to hold the crown sheet and eight on each side of the center line as shown in the drawing. The staybolts were spaced on four in. centers and the rigid bolts were ⅞ in. in diameter.

The two boilers were not as distinctly flexibly and rigidly stayed as were those used in the first tests. The boiler which has been designated as the rigidly stayed had a number of Tate flexible staybolts as indicated in the drawing. In the throat sheet all of the bolts in the seven upper rows and all of the bolts in the outer row, were flexible. In the side sheets there were 15 Tate flexible bolts in the front row, and 12 other scattering Tate bolts that had been put in for repairs, in the locations shown in the drawing.

The other boiler, which is designated as the flexibly stayed boiler, had a complete installation of flexible bolts in the throat sheet, with the exception of 20 bolts near the foundation ring that were rigid as shown in the drawing. Of a total of 510 staybolts in the side sheet, 248 were flexible bolts. These were located in equal numbers and with the same arrangement at the front and back end of the firebox. There were six in the top horizontal row next to the crown sheet, with a gradual increase from the top to the bottom as shown in the drawing and the photograph. This left a wide section of firebox at the center that was stayed by rigid bolts and which, evidently, exerted an important influence on the results as will be pointed out later.

The staybolts at which these tests were made were located at the numbered points 1 to 9 on the two drawings, and the tests were made as before, by raising steam, holding the throttle open for 30 minutes and then blowing down at the rate of 1 lb. per min., readings of the sheet movements having been made during the whole period at 10-minute intervals.

Whether it is because the apparatus used on the radially stayed boilers only indicated the apparent motion of the sheets while that used on the Wootten boilers indicated the actual movement, that the diagrams of these movements are much more complicated for the latter boilers cannot be stated positively. That the buckling that evidently did occur in the sheet of the radially stayed boilers had its effect on the actual movement of the sheets is a reasonable supposition, but certainly there is a great difference in the character of the two.

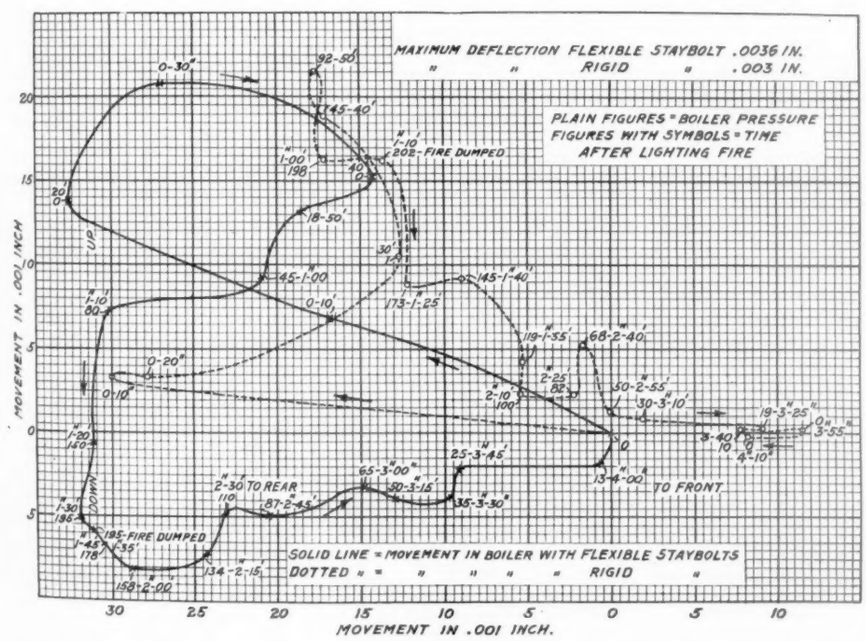
Comparison of Two Types of Boilers

Let us compare those for staybolts No. 1, in the two types of boilers: In the radial stayed boilers there is a steady even motion of the sheet with little or no doubling back and looping over itself. There was a constant movement, but it was, in the main, a progressive movement ending with an apparent deflection of about .008 in. from the starting point of the flexibly stayed boiler.

The rigidly stayed boiler was a little more complicated in its motion, but still not at all confusing, and ended with a deflection of a little more than .001 in. from the starting point.

The diagram for the corresponding staybolt of the Wootten boiler is a mass of knots and loops and back doubling. This is especially true of the period prior to the development of the first steam pressure. This appeared at the point marked O-2H-10′ in the diagram when steam began escaping from the whistle valve. Then there was a rapid upward movement for 20 minutes until a pressure of 75 lb. was reached followed by an equally rapid forward and downward movement during a quick building up of the pressure to 200 lb. Then came a quick recovery horizontally during the period that the throttle was open with only a very slight change in vertical position between the beginning and the end.

This movement is easily explicable if the tube action as indicated by other tests is taken into consideration. It was found that during the early period of raising steam the tubes were heated more rapidly than the shell with the result that the back tube sheet and with it, probably, the front end of the firebox was pushed to the rear. This explains the slight rear-


MAXIMUM DEFLECTION FLEXIBLE STAYBOLT .0036 IN.
" " RIGID " .003 IN.
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMBOLS = TIME AFTER LIGHTING FIRE
SOLID LINE = MOVEMENT IN BOILER WITH FLEXIBLE STAYBOLTS
DOTTED " = " " " " " RIGID "
MOVEMENT IN .001 INCH.
MOVEMENT IN .001 INCH

Staybolt No. 3 Top Row Back—Lake Shore & Michigan Southern Locomotive

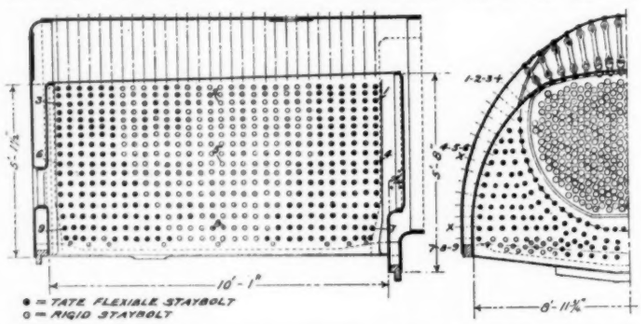
ward movement of the staybolt at the starting of the test. Then, as the water became heated there was a tending toward equalization of the temperatures of the tubes and the shell. This resulted in a relative forward movement of the tube sheet permitting the firebox to expand normally. Then, when the throttle was opened, there was a rapid increase of firebox temperature resulting in a corresponding increase in the temperature of the gases in the tubes themselves, which again pushed the tubesheet to the rear carrying the front end of the firebox with it. Then followed the looping and doubling of the movement during the cooling down, ending with the staybolt a little more than .002 in. from its original position.

In the rigidly stayed boiler the entanglement of the line of the movement is equally marked and is of the same general character, but, as in the other cases, the extent of the movement is much less.

This condition holds throughout the whole range of the work, varying in extent with the location of the staybolt and the method of staying. In general the movement was greater at the ends and upper portions of the firebox than at the center and lower portions.

There is another matter in connection with the rigidly stayed boilers that does not fully appear in the diagrams: The evident reason for the lesser deflection of the rigidly stayed boiler is that it is rigid. The staybolts tend to hold the sheets in one position and resist all tendency to move, and this manifests itself in the jerky character of such motion as takes place. That is to say, there are sudden variations in the distance from the original position which indicate that the stays resist the effect of the expansion of the sheet to move them, possibly buckling the sheet, and then when the pressure becomes more than they can carry, they suddenly yield.

The one point where a close comparison and check between the radially stayed and Wootten type is possible is in the movement of the staybolts when the boiler is in service. In both cases it was found that the sheets were in constant motion relatively to each other from the instant the fire was built until the boiler was cold. Also the extent



Delaware & Hudson Locomotive No. 813 with Flexibly Stayed Wootten Firebox

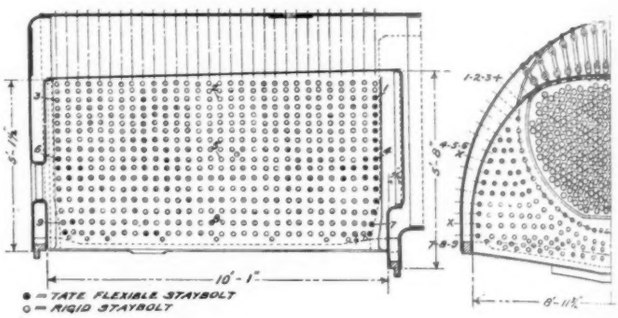
of the movement was much greater in the flexibly stayed boiler than in the rigidly stayed.

The character of the movement was, however, apparently quite different in the two types of boilers. There was more bending to and fro in the Wootten as well as a much greater movement. This is especially manifest in staybolt No. 1, where the maximum deflection of the flexible bolt in the Wootten type was about nine times that of the radially stayed, and this amount entirely in a vertical direction.

There may have been several reasons for this. The Wootten firebox was 1 ft. 4½ in. longer and 1 ft. 1½ in. deeper and the staybolt was 8 in. long as against 5¾ in. for the radially stayed boiler. Each of these items would tend to increase the deflection, while the comparatively small amount of horizontal deflection is explicable from the fact that there was a complete installation of flexible bolts in the radially stayed boiler, while, in the Wootten type there was a line of 18 rigid bolts in the central section that tended to stiffen the boiler and prevent a relative movement of the sheets. These are set forth as suggested reasons, not as demonstrated proofs.

The main fact, however, stands out very prominently that the character and amount of the staybolt deflection is quite different in the two boilers. As yet, there is not sufficient data accumulated to be able to state definitely as to just why this is so, and what should be done to the general design of one or both of the boilers to put the least possible strain on each.

In the matter of the buckling of the sheets caused by the



Delaware & Hudson Locomotive No. 794 with Rigidly Stayed Wootten Firebox

combined action of sheet expansion and resultant staybolt deflection, it was found that the buckling was greater with the flexible than with the rigid bolts; but, it must be borne in mind that the deflection was also greater, and a study of the details shows that the ratio of the buckling of the flexibly stayed to the rigidly stayed was less than the corresponding ratio of deflection. In other words, given a fixed amount of staybolt deflection the buckle put in the sheet would be less with a flexible than with a rigid staybolt.

While at work on the rigidly stayed boiler having the Wootten firebox an attachment was made in the space just ahead of the No. 5 staybolt. As might have been expected, the actual movement of the sheet was about the same as at the No. 5 staybolt but there was less buckling. This developed the probability that, in this long and wide firebox at least, the whole sheet, while under steam pressure, assumes a series of shallow corrugations that hold it out of alinement with its original shape, and which are sweeping over it in waves, as it were, according as the sheet expands or contracts. The depth of the corrugations is slight and the angle made by the sides of the same with the original line of the sheet is never as much as one degree. The greatest angle obtained on the Wootten type was 48 minutes 52 seconds with a general average for all points tested on the flexibly stayed boiler of 7 minutes 29 seconds.

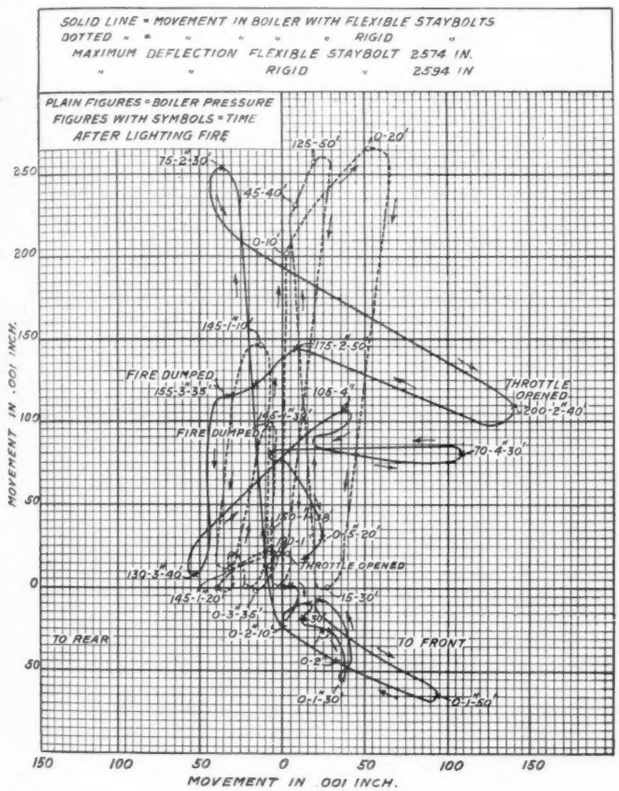
It is also possible that the buckling of the sheet might be appreciably decreased by a change in the original adjustment of the flexible staybolts, and also that there might be an increase in the deflection of the bolts. The suggested methods of accomplishing this is to give a little more play in the head of the bolt and the allowing of a little slack under the heads in the first place. This would permit of an easier adjustment to the movement of the sheet during the period of raising steam, when there is no load on the bolt, and the allowance of a little freedom of angular motion when the sheet and bolt are under strain.

Other matters were taken up in connection with this investigation for which there is no space to deal in full at this time. There were the effects of the admission of cold air to the firebox on sheet temperature and the apparent lack of circulation in the water leg.

Conclusions

The fundamental facts fully brought out were that the staybolt deflection is much greater in a flexibly stayed boiler than in a rigidly stayed boiler, that certainly during the whole period of operation and probably until the boiler temperature had reached that of the atmosphere the staybolt is in constant motion as evidenced by the fact that, out of the hundreds of measurements taken, there were no two consecutive measurements alike; that the two types of boiler construction (Wootten and radially stayed) have quite different effects on staybolt deflection; and that firebox temperatures and the action of the tubes have a marked influence on staybolt deflection at the front end of the firebox.

These tests also showed in a marked degree the extreme


SOLID LINE = MOVEMENT IN BOILER WITH FLEXIBLE STAYBOLTS
DOTTED " " " " " RIGID "
MAXIMUM DEFLECTION FLEXIBLE STAYBOLT 2.574 IN.
" " RIGID " 2.594 IN
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMBOLS = TIME
AFTER LIGHTING FIRE
MOVEMENT IN .001 INCH.
MOVEMENT IN .001 INCH.
TO REAR
TO FRONT
FIRE DUMPED
THROTTLE OPENED

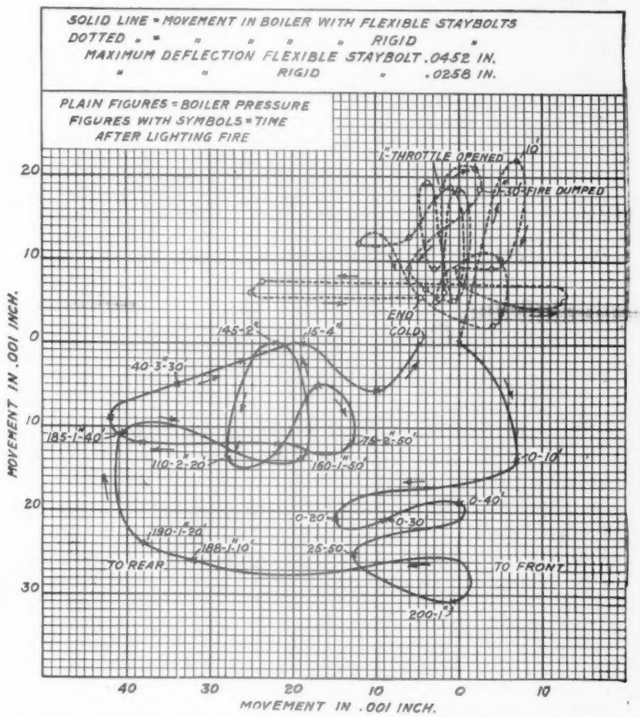
Staybolt No. 1 Top Row Front—Delaware & Hudson Locomotive

sensitiveness of the plates to changes of temperature. For example, a cold boiler may be filled with water of any temperature from cold to boiling and there will be no relative motion between the sheets. But let the fire be laid and a piece of lighted waste thrown in to ignite it, and it has, thus far, been impossible to get a reading before the sheets would show a movement, though this has been done within ten seconds from the time of the ignition of the waste.

This investigation is merely indicative and not conclusive. The absence of any data upon which to estimate the probable movement and buckling of the sheets made a redesigning of the apparatus necessary, and the use of boilers with a mixed assortment of staybolts in the second case, gave results that would probably be greatly modified were boilers with complete installations to be used. But there is this indication, that the boiler will expand and the staybolts deflect if they have a chance, and that this chance is much greater with a flexible bolt than it is with a rigid one.

As has already been intimated, the difference in the conditions of operation of the apparatus makes a clean-cut comparison between the Wootten type and the wide firebox radially stayed boiler impossible. But the impression left by the test is that the Wootten firebox is much more rigid than the wide firebox when rigidly stayed with the radial stays, and that if it were given a complete installation of flexible bolts the difference between the two would be very much greater than that indicated in these tests.

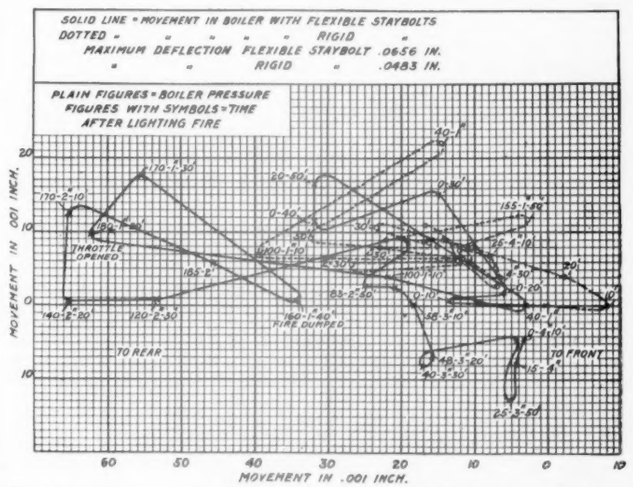
In every case the extreme sensitiveness of the sheets to


SOLID LINE = MOVEMENT IN BOILER WITH FLEXIBLE STAYBOLTS
DOTTED " " " " " RIGID "
MAXIMUM DEFLECTION FLEXIBLE STAYBOLT .0452 IN.
" " RIGID " .0258 IN.
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMBOLS = TIME
AFTER LIGHTING FIRE
MOVEMENT IN .001 INCH.
MOVEMENT IN .001 INCH.
THROTTLE OPENED
FIRE DUMPED
END COLD
TO REAR
TO FRONT

Staybolt No. 2 Top Row Center—Delaware & Hudson Locomotive

any changes of firebox temperature was noted. This fully explains the constant bending motion to which the bolts are subjected while the boiler is at work.

It naturally follows from this that a boiler which is so


SOLID LINE = MOVEMENT IN BOILER WITH FLEXIBLE STAYBOLTS
DOTTED " " " " " RIGID "
MAXIMUM DEFLECTION FLEXIBLE STAYBOLT .0656 IN.
" " RIGID " .0483 IN.
PLAIN FIGURES = BOILER PRESSURE
FIGURES WITH SYMBOLS = TIME
AFTER LIGHTING FIRE
MOVEMENT IN .001 INCH.
MOVEMENT IN .001 INCH.
THROTTLE OPENED
FIRE DUMPED
TO REAR
TO FRONT

Staybolt No. 3 Top Row Back—Delaware & Hudson Locomotive

built as to permit the sheets to expand under the influence of temperature changes, will put less stress upon the staybolts and sheets than one where such freedom of motion does not exist. There is no reason to think that there was any great difference in the temperatures of the sheets of the two boilers, and yet, as I have already indicated, there was

a marked difference in the movements of the staybolts and the sheets. If a given change of temperature produces a definite change of dimension in the sheet, anything that prevents this change must itself be subjected to stress and must put a similar stress upon the sheets. Hence, so far as these investigations have been carried, they indicate the value of using the flexible in preference to the rigid bolt.

There is one point that cannot be expressed in cold figures and that is the impression that this work makes on observers. After watching the delicate and sensitive movement of the sheets and staybolts and the difference in the action of the flexible and the rigid bolts, everyone was greatly impressed with the superiority of the flexible bolt as a means of reducing the probable stresses that the several parts of the boiler are called upon to sustain. The progress of this work has driven home in a convincing manner the advantages of flexibility in boiler construction.

Coal Strike Settled

THE STRIKE of the bituminous coal miners begun on November 1 at the call of the United Mine Workers was definitely called off on December 10 when the officers of the union at a meeting in Indianapolis agreed to accept a plan of settlement proposed on December 6 by President Wilson and sent telegrams to the striking miners urging them to return to work. The President's proposition was that the miners immediately return to work with the 14 per cent increase in wages which was recently offered by Fuel Administrator Garfield and which was put into effect for the men who remained at work by the coal operators, and that the President should appoint a commission composed of a practical miner, a mine owner or operator in active business and one other, which commission will consider further questions of wages and working conditions as well as profits of operators and proper prices for coal, readjusting both wages and prices if it shall so decide, including differentials and internal conditions in and between districts. The report is to be made within 60 days if possible and will be accepted as the basis of a new wage agreement, the effective date and duration of which shall also be determined by the commission.

The 14 per cent increase was given on the condition that it should not increase the government prices for coal and therefore comes out of the profits of the operators as long as the government's prices remain in effect. The original demand of the miners was for a 60 per cent increase in wages, a five-day week and a six-hour day. They refused to accept an offer from the operators of a 20 per cent increase and also the 14 per cent offer when made by Dr. Garfield.

Walker D. Hines, director general of railroads, authorized the following statement:

"The dislocation which the strike has created in the production, transportation and distribution of coal cannot be instantly remedied, and pending readjustment it is highly important for the public to continue to exercise great caution in the consumption of coal and it is hoped there will be a due appreciation of the difficulties which cannot be immediately overcome.

"During the strike the weekly production of coal was cut from 11 to 12,000,000 tons to about 5,000,000 tons and this much reduced tonnage was mostly mined in Pennsylvania and West Virginia. Widely distant portions of the country which were ordinarily dependent upon other coal fields had to be supplied from these and other unusual sources of supply. The central part of the country, the great consuming territory of the Mississippi and Missouri valleys, is depending on shipments from the East and West, 41 per cent of present production in the Allegheny and Pocahontas regions now being delivered to the West. The result has been that the Railroad Administration has been compelled to transport coal over the most unusual routes and for distances far in excess of the normal hauls. This has required a much greater amount of equipment than would be required in normal times to move the same tonnage to its usual destinations and has resulted in equipment constructed for use in special parts of the country being scattered widely to other parts of the country. A period of time will be required for the complete relocation of this equipment and meanwhile it is not to be anticipated that all mines can be fully supplied with cars.

"The director general today saw a committee of the National Coal Association and pointed out these difficulties and urged that as rapidly as that organization had information concerning the expected resumption of mining operations such information be duly communicated to the Railroad Administration as well as to the local railroad officers. There was manifested a policy to assist in this matter as far as practicable. It is hoped that the general public, the coal operators and the miners will appreciate these difficulties and make allowances for the time required to restore normal conditions.

"The loss of production of coal since the strike began 5½ weeks ago has been a serious economic loss to the country. In many important respects the losses to the country cannot be made up at all and it will require some time before coal production can bring the country's supply up to the point where it ought to be.

"At the beginning of the strike and when the fuel administrator turned over the distribution of coal to the Railroad Administration, the railroads had in their possession either in storage or in cars about 22,000,000 tons of coal. It is estimated that the consumption during November was 40,000,000 tons, of which 18,800,000 tons were produced during the month, 11,200,000 tons were used from consumers' stocks cumulated prior to November 1, and 10,000,000 tons were taken from the 22,000,000 tons in possession of the railroads.

"Since the end of November the stock in the possession of the railroads has been still further depleted.

"Of the 22,000,000 tons in the possession of the railroads at the beginning of the strike, 12,000,000 tons were held by the railroads for their own consumption, representing approximately 30 days supply. Subsequently the Railroad Administration adopted the policy of cutting its supply to 15 days and now as a temporary measure to aid in the most rapid possible meeting of the needs of other consumers the Railroad Administration will where necessary reduce the supply of coal for its own consumption to a 10 days supply.

"As a preliminary to bringing back normal conditions, the Railroad Administration will as soon as practicable place in effect an arrangement under which coal as mined will be allowed to run as billed except that tidewater and export embargo will continue; orders placed for coal to western regions from Pocahontas and Allegheny regions will be cancelled, but coal billed on these orders prior to cancellation will be permitted to go and be expedited, so that these cars can be promptly released for mines.

"Just as soon as practicable regulations in connection with the use of bituminous coal for power, light and heat will be rescinded or modified and the same is true of the supplying of coal to necessary industries. It will be necessary to observe conditions as the situation progresses before definite time can be fixed for changing of these regulations and orders.

"It is highly important for the public to realize that serious scarcity of coal is likely to continue for some time. It will require time to bring consumption of coal back to normal and meanwhile there is a tremendous shortage which needs to be made up. On all hands, therefore, great caution ought to continue to be the rule in the consumption of coal."

The question of the extent to which the curtailed passenger service can be further curtailed was to be taken up for consideration on Thursday.

Railroad Bill Debated in the Senate

Very Nearly Passed by Default; Senator La Follette Blocks Its Passage and Opens Attack on It

WASHINGTON, D. C.

THE RAILROAD BILL came near to being passed by the Senate by default but has since encountered what almost amounts to a filibuster by Senator La Follette. After having been before the Senate for a week as the unfinished business, while the attendance scarcely exceeded a dozen at any time except for roll calls, the Cummins bill was reported to the Senate from the committee of the whole on December 8, read the third time and a vote on its final passage had been called for, when the proceedings were interrupted by a call for a quorum by Senator La Follette. Some of the senators who were called into the Senate by the call for a quorum, however, displayed more interest in the matter than they had previously and on a motion by Senator Lenroot it was voted to reconsider the vote whereby the bill was passed to a third reading. This left it in the Senate as in legislative session and open to amendments.

On the following day the bill was restored to the committee of the whole and an attack upon it was opened by Senator La Follette. Only one amendment had been offered up to that time, that by Senator Curtis of Kansas to strike out section 7 of the bill, which provides for the creation of a transportation board. Senator Curtis explained that he was opposed to other provisions of the bill, such as that providing for compulsory consolidations, but thought the sentiment of the Senate could be tested by his amendment which would eliminate the transportation board. If this had been adopted he proposed to strike out other provisions of the bill relating to the functions to be exercised by the transportation board, but the amendment was rejected without a roll call.

Confidence has been expressed by Senate leaders that the bill can be passed before the holiday recess, tentatively set to begin on December 20, when it will go to conference for a reconciliation of the differences between it and the Esch bill. Senator Cummins on December 9 reported the Esch bill from the committee with a recommendation to strike out all after the enacting clause and that the Senate bill be substituted, in order to lay the foundation for a conference. There is no expectation that the conferees will be able to reach an agreement short of nearly a month but it is expected that after the passage of the Senate bill a resolution will be offered providing for a temporary continuance of the guaranty to the railroads.

Dirctor General Hines on December 9 submitted to the President a report on the railroad and legislative situation, after conferring with Chairman Cummins and Esch of the committees on interstate commerce and with other members of the Senate committee. This was for the information of the President in preparing his proposed message to Congress on the railroad situation which was expected to set at rest the question of the date for the return of the railroads. Many members of Congress seem to feel that the President might postpone the relinquishment for a short time after December 31 to wait for the completion o fthe permanent railroad bill, but there has been no confirmation to indicate that the belief is well-founded.

Senator Kellogg on Government Operation

Four formal speeches were made while the bill was in committee of the whole, by Senators Cummins, Kellogg, Curtis and Myers.

Senator Kellogg gave estimated figures for the earnings of the railroads showing a net income for 1919 of $536,500,000, or nearly $400,000,000 less than the standard return. He said the people are now paying over a billion and a half dollars more in expenses for handling less traffic in 1919 than was handled in 1917. In 1917 the Class I railroads earned 5.38 per cent on their property investment. In 1918, he said, they earned 3.71 per cent, and during the first six months of 1919 only .84 per cent. For nine months of the year the net operating income was 2.19 per cent and for the year it is estimated at 2.92 per cent, or less than the interest and fixed charges. For the nine months, Senator Kellogg said, 57 railroads earned $111,000,000 more than their fixed charges, while 108 railroads earned $168,000,000 less than their fixed charges.

Referring to statements by Director General McAdoo expressing the hope that large economies in operation would be accomplished, Senator Kellogg said that in no single department of railroad management, except possibly the legal department, has there been economy, but, on the contrary, enormous extravagance. He referred to the increase in the number of employees and while he said he would not contend that the general average wage of the principal classes of employees is too high, having been increased in about the same proportion as the cost of living since 1915, he criticized the policy of standardizing wages throughout the United States, irrespective of local conditions, and of allowing very large increases to some employees by reclassification. The inequalities, he said, have added grossly to the cost of operation, have created unrest and have had a bad effect upon the morale of the service.

Senator Kellogg commended the provision of the bill which would extend the guaranty temporarily, but he criticized the provision for division of so-called excess earnings above 6 per cent. He said it may be that the public necessity for keeping all the roads operating as efficient systems would justify a plan which would take away from the more fortunate a portion of what is called their excess earnings, but a sufficient percentage on the earnings above 6 per cent should be left with the road producing it to encourage economical operation and good service. He questioned whether the 5½ per cent return would be sufficient and pointed out that it is not merely the so-called weak roads, but the stronger roads which need most to borrow large sums of money with which to make large extensions and improvements and buy needed equipment. Senator Kellogg also put in the record voluminous statistical tables illustrating the effects of government operation.

"We are now facing the most tremendous economic problem ever presented to this country for solution, to a large extent incident to the direct result of the government's operation of the railways during the last two years," Senator Kellogg said. "When the President indicated, in December, 1917, his intention to take over, for government operation, all the railways of the United States, many were convinced that there was no necessity for it and that it would be disastrous. The experiment has amply justified all our fears. It has cost the taxpayers of this country hundreds of millions of dollars, destroyed the efficiency of the service, and placed the railroads today in a position where unless some drastic steps are taken this country faces a financial crash, which will not only destroy hundreds of millions in property held by the people of the United States but destroy the efficiency of our transportation system.

"When the war broke out we had in this country, all in

all, the best, cheapest, and the most efficient transportation system in the world. That it was not perfect goes without saying. But this is true, and will be conceded by substantially all the experts in the world, that nearly all the inventions, improvements, and advancements of transportation facilities have resulted from American incentive, genius, and energy and enterprise. An efficient and constantly growing transportation system is absolutely necessary to the very life and prosperity of this nation and must be had to maintain the growth of the country. In the main, the present deplorable condition of the railroads is due to inefficient and extravagant government management and stupid bureaucratic control. There was no necessity for taking over the railroads any more than there was for taking over the telegraphs, telephones, and cables, which has now been demonstrated beyond question, and which proved so expensive to the government and disastrous to good service. The postmaster general reports a loss to date of $14,418,237 in the operation of telephone, telegraph and cable systems, and there are many companies with which a settlement has not yet been made.

"Because there was temporary congestion on account of the sudden and enormous increase of business in a comparatively small territory, the President took over all the railroads of the United States for government operation, created a great central bureau, which, as everyone knows, always is inefficient. I do not claim that after the war broke out the transportation system of this country was sufficient to effectively take care of the sudden increase of business. But during the first nine months of the war the railroads themselves, with all the handicaps of government interference, priority orders, and laws which prevented the co-ordination of their facilities, handled as great a business under more adverse conditions at a less expense than has been handled by the Railroad Administration since that time."

Regarding the proposed guaranty during readjustment, Senator Kellogg said: "I think it is evident to everyone that the government, having produced this condition of the railroads, without regard to the merits of the increase of operating expenses, incurs the duty for a reasonable time, while the rates are being readjusted, to meet operating costs and continue its guaranty. We have no right to take over a public-service corporation and use it for government purposes, increase its operating expenses so as to render the property valueless, and turn it back without any remedy. Furthermore, should this be done, a financial collapse in this country is bound to follow, and as the bonds of these railroads are held in savings banks, insurance companies, and by millions of individuals, and are a large basis of credit, the greatest care should be taken to preserve their integrity.

"It may be said that the government, having taken over the railroads and fixed the rentals, owes no duty after the properties are turned back. The railroads were not consulted about being taken over. The Congress practically fixed the terms of the agreement, and the agreement was presented to the railroads to accept or reject, as they saw fit. Their only remedy, if they refused to accept the agreement, was to go into the Court of Claims, and sue the government—a remedy which, of course, was entirely inadequate, as the roads needed their income to pay interest and taxes.

"The true relation of the government to a public-service corporation is that the government has regulatory powers to prevent the companies from earning more than a reasonable income. But it has no right to reduce that income to the basis of confiscation or to take the property over and destroy it. So the least that can be done is to continue this guaranty for a few months while the rates and operating expenses are being readjusted."

Senator Myers devoted himself particularly to the anti-strike provisions of the bill, which he declared are absolutely necessary to the welfare, good order and domestic tranquillity of the people of the United States. The regulate commerce, he said, certainly includes power to prevent interference therewith or extinction thereof and he thought the time has come when Congress should create a tribunal to hear and determine disputes between railroad companies and their employees with power to enforce the granting of reasonable wages and fair working conditions, but as a corollary this should be accompanied by a provision to prevent a nation-wide or territorially extensive railroad strike from being suddenly and arbitrarily precipitated upon the people of the country.

Senator Myers on Anti-Strike Provisions

"In my opinion," Senator Myers said, "the time has come when the people are entitled to know whether their government is to be supreme in the realm of domestic tranquillity, general welfare, law and order, or whether a class of citizens, only a small part of the people, banded together by class organization, is to be supreme; whether the government or organized labor is more powerful. There appears to be in labor circles a belief that labor is now in the saddle and has things coming its way, and a determination to go to the uttermost extremity regardless of consequences."

Senator Myers expressed the opinion that the Adamson law was a grave mistake and that the country is now reaping its consequences because much of the trouble which has since arisen in regard to the operation of the railroads, much of the government's deficit in the operation of the railroads, may be traced to that act.

"As a result of class legislation in favor of wage workers," he said, "there has grown up in this country an inner government. It is inside of the regular or constitutional government. It is not an invisible government. It is very visible. It does not operate under the surface or behind the scenes. It is bold and open and very much aboveboard. The inner government consists of combined organized labor and it is a grave question if the inner government today is not superior to and more powerful than the constitutional government."

Senator Curtis Opposes Transportation Board

Senator Curtis moved to strike out the section providing for the transportation board, on the ground that the bill provides entirely too many boards and commissions and because he believed the Interstate Commerce Commission could do the work more satisfactorily and also because he was opposed to the plan of consolidation which under the provisions of the bill would be worked out by the board.

Senator Cummins said he sincerely hoped the Senate would not mutilate the bill in that way. If the amendment should prevail it would become necessary to re-form the entire measure because it would so destroy the machinery through which the bill is to be administered that it would become entirely unworkable. The time has come, he said, when the Interstate Commerce Commission must be largely occupied in what are known as quasi-judicial or semi-judicial duties and it is desirable to disassociate the purely administrative duties from them. He also said that one purpose of the bill is to prevent strikes and if strikes are to be prohibited it is necessary to create a governmental tribunal that will adjudicate the merits of a dispute between the employer and the employee. The proposed transportation board is to exercise this function where an agreement is not reached by the wage boards.

Senator King supported the Curtis amendment, expressing the opinion that the Interstate Commerce Commission could perform all the functions proposed for the transportation board, including final authority in wage matters.

Senator Cummins said there is no sanctity about the Interstate Commerce Commission, but agreed that it has or has had the confidence of the people and he wanted it to continue to have the confidence of the people but it cannot do so unless it can do its work with much more rapidity and much

more promptly than it has done its work in former times.

After a vote on the passage of the bill had been interrupted by the call for a quorum and the motion to reconsider, several senators objected to the rapidity with which the bill was apparently being put through. Senator Cummins replied to the effect that it was not his fault if senators were not sufficiently interested in the bill to be present and participate in the discussion and that the voting stage had been reached merely because no one had interposed anything else. He objected to a proposal to re-commit the bill to the committee of the whole, pointing out that it was open to any amendments that might be offered after the vote by which it was passed to third reading had been reconsidered.

Senator Thomas expressed wonder that the attendance had been so small during the consideration of a bill of such vast importance. He said he thought he could say with propriety and within bounds that except immediately after roll calls scarcely 10 senators had remained on the average during the speeches.

Senator Cummins on December 9 withdrew his objection to the restoration of the bill to the committee of the whole, after which Senator La Follette made a four-hour speech attacking the bill. He said it was a "railroad bill," on whose passage "railroad stocks will go kiting" and that T. De Witt Cuyler, of the Association of Railway Executives, and S. Davies Warfield, of the National Association of Owners of Railroad Securities, were responsible for it. His argument followed closely that of his minority report, in which he urged a five-year extension of government control, and charged that the railroads had broken down in 1917.

Senator Dial of South Carolina opposed the bill because he said it undertook to say that every dollar invested in railroad property shall receive enough return to pay 5½ per cent interest on the value of the property. He objected to this because of the great difficulty in finding out the value of the railroad property and also because he seemed to be under the impression that the bill was to guarantee to every railroad that has not been making as much as 5½ per cent a return equal to that amount for all time to come.

Senators King, Cummins and Pomerene tried to disabuse the senator's mind, but apparently made little impression. They pointed out that the bill does not contain any guaranty, but merely an instruction to the commission to make rates produce as nearly as may be to 5½ per cent, that many railroads under the bill would receive much less than 5½ per cent, while others would receive more and would have to give up two-thirds of the excess over 6 per cent. Senator Cummins also pointed out that provision was made for a readjustment of the rate of return by the Interstate Commerce Commission after five years, but Senator Dial continued his speech on the assumption that it was proposed "to stamp a certificate of value upon every dollar invested in railroad property, without taking into consideration whether or not it was necessary to build more railroads or whether it was necessary to maintain them." He said he did not complain of the rate of 5½ per cent because if he could have gotten that rate on the money he had borrowed during his life he would be much better off today, but he objected to giving that percentage to all railroads. He said that government operation had been generally conceded to have resulted in failure, but he thought the failure was not so great as had sometimes been made to appear and that the results of the war should be taken care of by paying the bills and a new start made. He suggested that instead of an elaborate bill in an effort to stabilize railroad returns, it would be preferable to write a short bill promising the railroads the return of their properties after 90 days or something like that with a provision for the guaranteed standard return for six months to allow them to get back to the old basis of operation and to become normal again. Then, he said, if the anti-combination law ought to be repealed it could be repealed later and he would like to repeal also the Adamson law.

Senator La Follette resumed his discussion on Wednesday. It was reported that he had planned a twelve-hour speech.

Imperator Takes Too Much Coal

THE STEAMSHIP "Imperator" which had been held up at the request of the Railroad Administration for loading too much coal was allowed to depart from New York on December 11. Following a conference between representatives of the Railroad Administration, of the British Ministry of Shipping and of the Cunard Line, regarding the loading of 5,900 tons of coal in excess of amount of 2,500 tons for which permit was issued by the Railroad Administration acting under authority of the Fuel Administrator. The British Minister of Shipping has expressed his regret over the occurrence, and offered to replace the coal so loaded in violation of the regulations of the Railroad Administration within one month. As a result of the Railroad Administration, with the concurrence of the Department of Justice officials handling the matter, requested the Treasury Department to grant the "Imperator" clearance, it being understood, however, that this action will in no way impair civil or criminal action in connection with the supplying of this coal by the coal companies involved or the receiving of it by the steamship. Permit had been issued only for coal sufficient to take the boat to Halifax, the first available coaling station. Following the conference correspondence on the subject was exchanged and made public.

The letter from S. M. Raeburn, director general of the British Ministry of Shipping to H. B. Spencer, chairman, Central Coal Committee of the Railroad Administration, said:

"The British government is the owner of S. S. Imperator which is operated for and on behalf of the British government by the Cunard Line. I have been informed that owing to an error, which the British Ministry of Shipping greatly regrets, 5,900 tons of coal have recently been loaded on board her without due permit and that yesterday clearance was refused the vessel at New York on this account, and that the excess coal, amounting to 5,900 tons, has been ordered removed from her, and that clearance papers will not be granted until this coal has been removed. I submit herewith copy of report of survey held December 9, 1919, at 6.00 p. m. by technical experts, from which it appears that owing to the structural conditions of the ship and the arrangement of her stoke holds and bunkers, it will take at least a period of seven weeks to remove the coal. I am further advised that the vessel while lying at her pier is consuming about 240 tons a day.

"The British government and the British Ministry of Shipping had no knowledge of any violation of any United States statute or regulation, and desires to clear the vessel so soon as possible. To that end, I offer on behalf of the British government, if the vessel is allowed to clear tomorrow, to replace the coal taken in excess of permit, that is to say, 5,900 tons, and to do so at New York harbor within one month of the date of vessel's clearance. Every effort will, of course, be made to get the coal here sooner, if possible."

The coal turned over in reparation must be coal produced outside of the United States.

THE CALIFORNIA RAILROAD COMMISSION has denied the petition of the Pacific Electric Railway Company for authority to increase freight rates on petroleum, c. l. The company desired to place its rates on a parity with those charged by competing federal controlled roads, but the Commission finds that the proposed change would result in advances ranging as high as 225 per cent.

A. R. A. Issues New Specifications for Track Scales*

These New Rules Are the Work of a Joint Committee Representing a Number of Associations

THE AMERICAN RAILROAD ASSOCIATION has issued a new set of specifications for the purchase of track scales, which were drawn up by a joint committee representing the American Railway Engineering Association, the United States Bureau of Standards, The Railroad and Warehouse Commission of Minnesota, the National Scale Men's Association and the Scale Manufacturers' Association. The specifications are modeled largely after those previously prepared by the Bureau of Standards and the Minnesota commission, and, with the standing they will have under the sponsorship of the American Railroad Association, they are certain to effect a distinct advance in scale practice.

They are intended to apply to knife edge scale of the straight and torsion lever types for weighing cars in regular interchange service. They do not apply to overhead suspended scales, nor to scales now in service, except that reinstallations of old scales should be governed as nearly as practicable by the provisions of the specifications relating to the installation of new scales. They are intended, except in special cases, to secure reasonable uniformity in scales for similar service, but without preventing improvements in types of scales or in scale parts.

Classes of Scales

Character of Classification: Scales shall be divided into two classes, namely, heavy service scales and light service scales; and except when otherwise specifically provided these specifications are to apply to both classes of scales.

Heavy Service Scales: Heavy service scales are those over which a large number of cars are to be weighed; and they shall have sectional capacities of 75 or 100 tons, except for special cases.

Light Service Scales: Light service scales are those over which only relatively few cars are to be weighed; and they shall have sectional capacities of 60 or 75 tons, except for special cases.

Special Cases: For special cases which cannot be covered in these specifications, it is recommended that the material, workmanship, etc., shall be at least equal to that required in these specifications, and that the principles herein set forth be followed in so far as they apply.

Capacity

Capacity Defined: The capacity of a scale is equal to the weight of the heaviest car it will weigh, provided that the scale will support a train of such cars passing over the scale without stresses being developed in the members of the scale which are in excess of those hereinafter specified.

Sectional Capacity: The sectional capacity of the scale is the greatest weight which, if applied on the load knife edges of each pair of main levers, will produce stresses in the scale parts not exceeding those given in the table of working stresses.

Plans

Plans: The manufacturer shall furnish to the purchaser plans of design showing stresses and detailed dimensions for all scale parts, and the material of which they are to be fabricated; also assembly plans showing location of all field connections and all information necessary for the purchaser to design and construct the pit and parts not furnished by the scale manufacturer.

Working Stresses

The following unit stresses shall not be exceeded when the scale is loaded to its capacity as defined above. These stresses include an allowance for impact caused by moving loads. The strength of each member shall be determined by its weakest cross-section.

*Abstracted from the complete specifications.

Iron and steel working stresses in pounds per square inch:

IRON AND STEEL, WORKING STRESSES IN POUNDS PER SQUARE INCH

Nature of stress	Cast iron	Steel Castings	Machinery steel	Structural steel	Steel for pivots and bearings: High carbon	Steel for pivots and bearings: Special alloy
Tension	1,500	8,000	8,000	10,000	24,000	30,000
Compression	8,000	10,000	8,000	10,000	24,000	30,000
Transverse bending:						
Tension	2,500	8,000	8,000	10,000	24,000	30,000
Compression ..	8,000	10,000	8,000	10,000	24,000	30,000
Shear	2,500	6,000	5,000	7,000	.....	.....
Torsion	2,500	6,000	.....	7,000	.....	.....

The bearing stress on steel pins shall not exceed 15,000 lb. per sq. in.

Knife Edge Bearing Stresses: For heavy service scales the load per linear inch of knife edge shall not exceed 5,000 lb. for high carbon steel or 6,000 lb. for special alloy steel.

For light service scales the load per linear inch of knife edge shall not exceed 6,000 lb. for high carbon steel, or 7,000 lb. for special alloy steel.

Concrete Bearing Stresses: Stresses to be allowed for bearing on concrete shall not exceed 300 lb. per sq. in. under scale lever stands, and at all other points shall not exceed 400 lb. per sq. in.

Loops, Formula for Stresses: Considering the end of the loop as a simple beam, its section at the point of maximum bending shall be determined by the formula $\frac{W}{4}\left\{L-\frac{l}{2}\right\}$ wherein W equals the maximum load applied to the loop, L equals the distance between the center lines of the depending sides, and l equals the distance over which the load is distributed.

LENGTH OF SCALE AND NUMBER OF SECTIONS.

Scale Length Defined: The length of a scale shall be considered as the effective weighing length of the live rails. In no case shall this effective weighing length be greater than the distance between the centers of end sections.

Scale Lengths Standardized: The length of scales, except in restricted traffic movements, or for special cases, shall be 50, 56 or 60 ft.

Number of Sections: Scales of 60 ft. or less in length shall not be constructed in more than four sections.

Motion Weighing: When cars are to be weighed in motion the speed shall not exceed four miles per hour, and each car shall be entirely and alone on the scale a minimum of three seconds. This condition applies to cars normally weighed. When scales are of such a design or length as not to permit of the above condition, cars shall be spotted to secure accurate weights.

Scale Levers

Machined Ways for Nose Irons: Levers that are to be equipped with nose irons shall have those portions of the lever ends receiving them machined for the full distance over which the nose irons are to move.

Leveling Lugs: In scales of the straight lever type each lever shall be provided with leveling lugs for longitudinal alinement. In scales of the torsion lever type, leveling lugs shall be provided on the pipe or torsion member for transverse alinement and on the extension arm for longitudinal alinement. Each pair of lugs shall be spaced 11 in. The leveling surfaces of each pair of lugs shall be finished to a common plane which shall be parallel to the plane established by the knife edges of the end pivots.

Length, Allowable Variation: All main levers shall be true to within ⅛ in.; and all extension levers shall be true to within ¼ in. of their nominal lengths between the knife edges of end pivots.

Loading of Levers Other Than Main Levers: In establishing the load for determining the stresses in the levers other than main levers, it shall be assumed that the end extension levers carry a total live and dead load corresponding to 100 per cent

of the sectional capacity; the portion of the middle extension levers carrying the load from the end section only, 100 per cent of the sectional capacity; and the portion of the middle extension levers carrying the combined load from the end section and inner section, 160 per cent of the sectional capacity; the transverse extension lever, shelf lever and beam, 300 per cent of the sectional capacity.

Pivots and Knife Edges

Material: The requirements for physical properties of the steel used for pivots shall be as follows:

Special Alloy Steel in the Annealed State:

Elastic limit	Not over 75,000 lb. per sq. in.
Tensile strength	Not over 110,000 lb. per sq. in.
Elongation in 2 in.	Not les than 20 per cent.
Reduction in area	Not less than 35 per cent

Special Alloy Steel Hardened:

Elastic limit	Not les than 160,000 lb. per sq. in.
Tensile strength	Not less than 200,000 lb. per sq. in.
Elongation in 2 in.	Not less than 5 per cent.
Reduction in area	Not less than 25 per cent.
Shore hardness	Not less than 85.

High Carbon Steel in the Annealed State:

Elastic limit	Not over 55,000 lb. per sq. in.
Tensile strength	Not over 117,000 lb. per sq. in.
Elongation in 2 in.	Not less than 15 per cent.
Reduction in area	Not less than 25 per cent.

High Carbon Steel Hardened:

Elastic limit	Not less than 135,000 lb. per sq. in.
Tensile strength	Not less than 180,000 lb. per sq. in.
Elongation in 2 in.	Not less than 3 per cent.
Reduction in area	Not less than 12 per cent.
Shore hardness	Not less than 85.

Design: All pivots shall be designed and manufactured so that the two sides joining to form the knife edge shall make an angle that will not exceed 90 deg.; that the tolerance for offset of the knife edge of the pivot, as figured from the center line of the pivot at its base, shall be within 10 per cent of the width of the pivot for "machined in" pivots, and 15 per cent of the width of the pivot for "cast in" pivots.

Machining: For heavy service scales all pivots of the main levers shall be machined and fitted into machined ways.

Continuous Contact: All pivots shall be mounted so as to secure equal and continuous contact of the knife edges with their respective bearings for the full length of the parts designed to be in contact; in loop bearings the knife edges shall project slightly beyond the bearings in the loops.

Position: The pivots shall be so mounted that each knife edge in a given lever will be maintained in a horizontal plane under any load; and shall be so mounted that a plane bisecting the angle of a knife edge wil be perpendicular to the horizontal plane established by the knife edges of the end pivots, and shall be so mounted that the knife edges in a given lever will be parallel to each other.

Support for Projecting Pivots: The reinforcing on the levers to support projecting pivots shall be tapered off to prevent lodgment of dirt next to the pivots and to provide proper clearances.

Location of Main Lever Load Knife Edges: The load knife edges of the main levers shall be so located that the center line of the live rails can be placed in the vertical plane established by the centers of those knife edges.

Nose Irons

Design and Fastening: The nose irons shall be firmly fastened in proper position by means of screws or bolts of a recognized standard size and thread, or other equally effective mechanical devices.

The means for clamping nose irons in position shall be of such design that identations in the lever will not be made, and shall be independent of any means provided for adjustment.

The means for clamping nose irons in position shall force or hold them against the lever in the same direction as they would be forced by the load.

The movement of the nose irons shall be controlled by means of adjusting screws of recognized standard size and thread. These screws shall be made of a material which will not corrode.

Finish and Pivot Mounting: Those surfaces of the nose irons intended to come in sliding contact with the levers shall be made true so as to secure an accurate fit of the nose irons on or in the levers. Each nose iron shall be of such design that when adjustments are made the knife edge will be held parallel to its original position.

Lever Fulcrum Stands

Design: The height of the pillars and the dimensions of the bases of the stands shall be sufficient to prevent a tipping action. In stands of the two-pillar type, both pillars shall be of equal height.

The pillars or upright portions of the stands carrying the bearings shall be so placed on the bases that the centers of the bearing lines shall be over the center of gravity of the bearing surfaces of the stands.

Bases for Lever Stands: The bases of the stands shall be finished to within a tolerance of 1/32 in. or machined when to be mounted on metal bed plates; accurate to a plane perpendicular to the axis of the upright portion of the stand, and the knife-edge bearing line shall be parallel to the surface of the base.

Pillars, Finish of Tops: The tops of the pillars for receiving the bearing steels, caps or blocks shall be finished to a tolerance of 1/32 in.

Bearings, Bearing Blocks and Links

Material for Bearing Steels: The bearing steels shall be equal to or greater in hardness than the knife edges which oppose them. It is found good practice to have the bearing steels not less than 95 points hardness on the Shore recording scleroscope for high carbon steel, and not less than 90 for special alloy steel.

Design of Bearings: Scales shall be so designed that, when the load is applied to the live rails, the oscillation of the weigh-bridge will not displace the bearings at points of contact on the knife edges.

Mounting of Bearing Steels: All like bearing steels shall be interchangeable or mounted in interchangeable bearing steel blocks. When the steels are separable and interchangeable in the blocks they shall be fastened in position by means of set screws of a recognized standard size and thread, and of a material which will not corrode, or by other equally effective devices.

Weigh-Bridge Bearings: The tops of weigh-bridge bearings making contact with the weigh-bridge girders shall be finished to within 1/32 in. of a true plane that will bring them all to the same height when in position, and in a plane parallel to the bottom of the bases of the fulcrum stands. These tops shall be provided with bolt holes of a sufficiently large diameter to allow for adjustment both tranversely and longitudinally to secure a proper alinement of parts.

Loops and Connections

Design Proportion: In loops which form bearings for projecting pivots, the radius of the portion of the bearing making immediate contact with the knife edges and the radius of the eye of the loop shall be not less than the length of the longest side of the cross-section of the pivot to be used in the loop.

Length: All loops in like connections, except where made adjustable, shall be of the same length.

Checks

Type: All weigh-bridges shall be checked by adjustable checks of the rod or other approved type which shall be equal to the rod type in functioning. Both longitudinal and transverse checks shall be provided.

Number: Not less than four longitudinal and eight transverse checks shall be provided. When the rod type is used, they shall be assumed to act in tension only.

Strength: The combined area in square inches of the check rods at either end or side shall be not less than the sectional capacity in pounds divided by 60,000 when steel check rods are used.

Weigh-Beam and Accessories

Capacity: The maximum capacity of the beam shall be not greater than 1⅔ times the sectional capacity.

Full Capacity Beam: Except for special cases a beam of the full capacity type shall be provided.

Notches: The number of notches for the main poise shall not exceed six per inch.

Registering Beam: Scales that are to be used exclusively for

spot weighing of cars or carload freight shall be equipped with a type registering, or other registering beam, of a capacity that will enable the entire load to be weighed in one draft, and without the use of additional weights of any kind, except for special weighing.

Fractional Bar Stops: On registering beams the fractional poise shall be equipped with means to insure a positive stop at any 20-lb. interval, and a stop shall be provided to prevent the movement of the fractional bar beyond its proper travel in either direction.

Operating Lever: A substantial double or other approved type of hand grip shall be provided to facilitate the printing or registering of the weight on the ticket with the least possible disturbance of the beam.

Receptacle for Weight Ticket: On registering beams, means shall be provided to prevent the placing of the weight ticket in its receptacle in any position in which an incorrect weight can be registered.

Intervals: The notches and graduations on the main beam shall be made at the thousand-pound intervals.

Balance Ball: A balance ball shall be provided and its movement shall be controlled by means of a self-contained hand operated screw or other device which will not require that the ball be rotated in making any adjustments. A means for locking the ball in position shall be provided. The balance ball shall be provided with vertical adjustment.

Counterbalance Weight: If counterbalance weights are to be used, the lower end of the hanger stem shall be threaded; a cup for the loose balancing material shall be screwed to the lower end of the stem and each additional weight shall be provided with an elongated hole in the center through which the hanger stem may pass. No slotted counterbalance weights are to be used. When no counterbalance weights are necessary on top of the counterbalance cup the cavity shall be closed by a cover, secured in a positive manner. No counterbalance weights shall be used in any place in the scale, except at the beam.

Multiplication: A pivot with a loop shall be provided at the tip of the beam. The multiplication to this pivot knife edge shall be 7,000 or 10,000, which shall be plainly and permanently stamped on the beam.

Beam Fulcrum Stand: The beam shall be supported on a stand provided with compensating bearings, and shall not be suspended. The height of the pillars and the dimensions of the base of the stand shall be such as to prevent a tipping action.

The bearing surface of the base of the stand shall be finished to a plane perpendicular to the axis of the upright portion of the stand, and the knife-edge line of the bearing shall be parallel to the base. The center of the bearing line shall be vertically over the center of gravity of the bearing surface of the base.

Trig Loop: The contact parts of the trig loop shall be made of a non-magnetic material.

The play of the beam in the trig loop shall be not more than 2 per cent of the distance from the trig loop to the knife edge of the fulcrum pivot.

The beam shall be fitted with a pointer to be used in connection with a fixed graduation or other device on the trig loop to indicate a central position in the trig loop when the beam is horizontal.

Anti-Friction Points and Plates

Required: Anti-friction points and plates shall be provided to limit the relative lengthwise displacement of all knife edges with respect to their bearings.

Material: The anti-friction points and plates shall be made of hardened carbon steel and the plates shall be at least as hard as the points which come in contact with them.

Clearances: The clearances between the anti-friction plates and anti-friction points shall not exceed 1/16 in. on the beam, ⅛ in. on the shelf lever, and ¼ in. on all other levers, and the minimum clearances shall be not less than one-half these amounts, respectively.

Clearances

The clearance around and between the fixed and live parts of the lever system of a scale shall be at least ¾ in. except at points where other clearances are specified.

Factory Adjustments

Levers: The design, workmanship and factory adjustment of the levers and beam shall be such that the proper ratio of the lever arms will be maintained.

Beams: Each notch in the beam shall be adjusted to within .002 in. of the nominal distance from the zero notch.

Interchangeability

Like parts of all like scales of the same design and manufacture shall be interchangeable unless otherwise herein specified. The scale drawings and the parts of the scale shall be marked to indicate the proper positions of the parts in the scale, so as to prevent parts not symmetrically designed being incorrectly placed when the scale is set up.

Sensibility Reciprocal

Definition: The sensibility reciprocal shall be that weight required to be added to or removed from the live rails to turn the beam from a horizontal position of equilibrium in the center of the trig loop to a position of equilibrium at either limit of its travel.

Value: The sensibility reciprocal shall not exceed 50 lb. in any case.

Tolerance

The manufacturers' tolerance to be allowed on the first field test, after installation corrections, of all new railroad track scales shall not exceed 1/20 of 1 per cent, or 50 lb. per 100,000 lb., for any position of the test car load on the scale. The minimum test car load to be applied shall be 30,000 lb.

Scale Weigh-Bridges

Type of Girders: In scales of more than two sections, weigh-bridge girders may be either of the continuous type or the non-continuous type, but non-continuous girders of such design of joints over centers of bearings as will admit of flexure vertically without derangement of sections are recommended.

Steel Specifications: Structural steel work shall conform to the specifications of the American Railway Engineering Association.

Bracing: Each weigh-bridge span shall be designed for a lateral force of 200 lb. per lin. ft. plus 4 per cent of the sectional capacity of the scale, applied at the top of the live rail and uniformly distributed.

Diagonal Bracing: Diagonal bracing shall consist of not less than 3-in. x ⅜-in. angles and not less than three diagonals per span shall be used, or the equivalent of this bracing shall be employed.

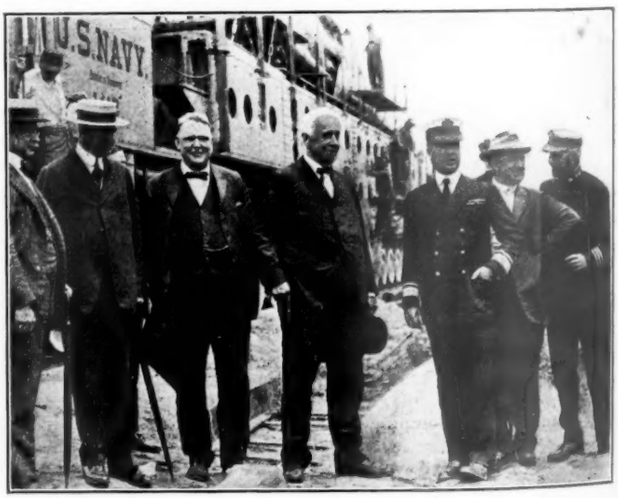


Photo from International Film Service

Samuel M. Vauclain, President of the Baldwin Locomotive Works (center) and Other Representatives of the Baldwin Works at the Tests of the 14-in. Naval Gun at Dahlgren, Va.

The Essentials of Efficiency in Railroad Shops*

Machine Tools and Other Facilities Are Far Behind Developments in Motive Power and Cars

By Frank McManamy
Assistant Director, Division of Operation, United States Railroad Administration.

SHOP EFFICIENCY is a subject that is usually very closely associated in the minds of most of us with intensive production and stop-watch studies of the different operations in connection with shop output, and from that viewpoint it is a subject which can never be exhausted. There is no doubt but that a great deal has been and can be accomplished in that way in the matter of increasing production, although it is usually done at the expense of a more or less serious dispute with the workmen. I have sometimes found that while making time studies of shop operations with split-second stop-watches, we were overlooking conditions and methods where the time that might be saved could be measured with the hour-glass, and that we are, in many of our shops, using machines and methods that are as far behind the most modern and up-to-date practices as the hour-glass is behind the split-second stop-watch.

The transportation machine has, perhaps, been left by the war in more nearly a normal condition than any other industry for the reason that while it was worked to capacity during the war—in fact, most of the time was overworked—yet, owing to the limited facilities, it is not possible to greatly enlarge the plant, and there are no greatly increased forces because both were impossible to obtain during the war. The increased transportation furnished represented almost wholly increased effort on the part of those producing transportation and increased output of existing facilities.

The change which appears to be most important and far-reaching, so far as the railroad shops are concerned, is the change in working conditions and the increase in the rates of pay of railroad shop labor, both skilled and unskilled, and to my mind, this is a change which is permanent; therefore, it must be reckoned with in all calculations relating to the purchase or maintenance of shop equipment. These changes have made it essential to see that our men are provided with modern tools and improved facilities, because in no other way can operating costs be reduced.

The use of out-of-date tools and machinery in railroad shops—although never satisfactory—may have been in the interests of economy at the rates paid for labor before the war, but under the rates now paid the use of inefficient machinery is not only unsatisfactory but decidedly expensive.

It is a well-known fact that many railroad shops, together with their equipment were, at the time the railroads were taken over by the Government, and are today almost hopelessly out of date, and that the methods which this lack of facilities makes necessary are such that no manufacturing industry, operated on a competitive basis, could practice and exist. In fact, it has been stated that $10,000,000 spent for shops and shop machinery prior to 1917 would have made it unnecessary for the Government to have assumed control of the railroads. Whether or not this statement is true, it is a fact that one of the principal reasons for taking over the railroads was the condition of locomotives and cars in certain sections of the country which, together with insufficient terminal facilties and the effort of many shippers to use the cars as storehouses, caused such a congestion that nothing short of centralized control with complete authority could have met the situation.

*Abstract of a paper read before the New England Railway Club.

A survey of the situation immediately following Federal control showed many railroads hopelessly behind in the matter of repairs to equipment, due to their limited shop capacity, although it was proved that the total shop capacity of the country, if properly distributed, was sufficient to maintain the equipment. The inadequacy of existing shops and the character and quantity of shop machinery was one of the things that received immediate consideration from the Railroad Administration, and while it was impossible in the time at hand and under war conditions to start and complete large, new projects, the matter of providing additional equipment and facilities at existing shops received earnest consideration and vigorous handling.

Investigations of shops and shop facilities during this period confirmed a belief that many of us had that the importance of having shop facilities on any railroad keep pace with other improvements is usually neglected and frequently entirely overlooked. To promote efficient operation, grades are cut down, curvature reduced, terminal facilities are added, bridges and roadbed improved and strengthened to meet the requirements of new and heavier equipment, but the last thing that is given consideration—if, in fact, it receives any consideration at all until it is forced by the condition of power and terminal delays—is the question of providing shop and roundhouse facilities for the new and heavier equipment.

The general rule in the matter of making improvements is that if the saving to be brought about by the improved facility will pay the carrying charge on the investment, the improvement is a justifiable one, and under this rule, we have all seen locomotives and other equipment scrapped because of obsolescence—that is, because the work performed by the more modern equipment was sufficient to pay the carrying charge on the investment and, therefore, the additional investment was justifiable. Locomotives from 15 to 20 years old are either modernized by rebuilding or scrapped to make room for modern power, yet a trip through the shops on practically any railroad will show that we are trying to maintain this modern power with shop tools and machinery, much of which is more than 50 years old and which should have been replaced by modern equipment years ago.

I am familiar with the statements which will probably be made that the reasons for failure to provide proper equipment in the shops is because of the difficulty in financing, but this does not cover the case because a check of the service performed by locomotives and the time lost at terminals will show that in many cases it would have been profitable to have spent the money that was spent for the last order of locomotives in providing shop facilities to maintain locomotives already on the line and that, if this had been done, the additional locomotives would not have been needed.

Efficiency

Efficiency, as applied to railroad shops, is, therefore, the ratio of the shop output to the time, labor, material and capital expended. In order that a railroad shop may be efficient it is necessary to have: first, suitable shop buildings with proper equipment and lay-out; second, an effective shop organization; third, necessary schedules so that the

various departments of the railroad in any way related to the shop organization may coordinate their efforts.

The efficient railroad shop must have as its fundamentals proper equipment suitably disposed and properly housed. It is difficult to understand, in view of the saving to be effected thereby, why we have so long failed to erect suitable buildings for shop purposes, and this not only applies to the car department where suitable buildings do not exist, but also to the locomotive department where the loss of output in decreased efficiency due to placing machines in badly lighted, poorly arranged buildings where unusual effort is required to deliver material to and from machines which are not accessible, even to an ordinary warehouse truck, is really a very serious question. So far as possible, the travel of material through the shop should be arranged to eliminate backhauls. The material should move in as nearly a straight line as possible from the foundry or smith shop to the locomotive or car. I have seen shops where driving-box brasses were machined at one end of the shop and pressed into the box at the other end of the shop, several hundred feet distant; then returned for boring.

When any new shop machinery is requisitioned at the present time, the purchase is objected to on the grounds of the high cost, and this argument has been very effectively used. We must now, however, consider this in the light of the comparative cost for machinery and labor, and when we consider the rate paid to shop labor at the present time, we will realize that in the life of the average machine, its cost will be paid many times by the saving in the time of the workmen, to say nothing of the increase in efficiency and shop output and the additional service obtained from locomotives and cars, which are often sorely needed.

A very costly part of shop operation is the handling of material in the shop. For that reason, crane transportation, where it can be installed, is desirable, and in any event, wide aisles for the trucking of material should be provided.

Shop machinery should be located with a view to the use to be made of it, with machines or appliances for each particular kind of work in one group. For example, all the work belonging to the valve motion should be handled in one place. Similarly, driving-box work and brake rigging work should be located in one particular portion of the shop.

Someone has said, "Information is the essence of efficient operation." Nowhere is this more true than in the proper conduct of a railroad shop and, generally speaking, in few places is information as to probable requirements so sparingly furnished. Locomotives sent to the shop for repairs which are said to require the renewal of a set of flues are found to require fireboxes, and locomotives sent to the shop for fireboxes are found to need only a set of flues. It is of great importance that proper record of the condition of locomotives and cars be kept and the shops furnished as much in advance as possible with information as to the repairs which will be required on equipment destined for the shop within the next two or three months, in order that the shops can provide the necessary material when the locomotive or car is placed in the shop, thereby avoiding the too common practice of having them occupy valuable space while waiting on material.

Organization

Organization is defined as "A systematic union of individuals in a body whose officers, agents and members work together for a common end." This is especially applicable to railroad shops where the ends sought are efficient production and minimum costs. While to some it may seem unfair that brilliant, individual performances should be submerged in an average, at the same time, whether in baseball or business, team work is essentially the thing that counts.

Without an organization embodying as well as implying cooperation, little, if anything, will be gained, and this is entirely up to the supervision. Each investigation made of points where shop output is unsatisfactory confirms the belief which I have long had that effective and constant supervision is necessary in order to obtain a satisfactory output. Quality as well as quantity in production comes from the top downward. The average workman will give you, in the matter of output, exactly what you are willing to take. If the supervision is satisfied with a minimum performance and low-grade work, that is exactly what they will get.

If we are to have efficient operation in any shop, we must have supervision that is constantly on the job, and will show that the officials and foremen are as much interested in both the quantity and quality of output as they expect the workmen to be, and that they are willing to aid in promoting efficiency by seeing that the workmen have: first, a suitable place to work; second, necessary tools that are as well maintained as they can be, and third, material and supplies promptly delivered so that the workmen will not be required to lose time waiting for their helpers to obtain material from a storehouse inconveniently located, or have to hunt it themselves from the scrap pile, or rob other locomotives or cars in order to obtain it.

An important factor in obtaining shop output is properly scheduling the work through the shop so that the work of the various departments may be properly coordinated and in harmony. Scheduling will have a decided influence to keep everything moving and avoid delays due to one department waiting on another, and these schedules should not be interrupted from day to day by switching in jobs of running repairs which could perhaps be better performed in the roundhouse.

Locomotive schedules must be made very carefully. It is almost as much of a task to make out a proper schedule for locomotives through the shop as it is to make out a time card for a division. Schedules that work satisfactorily in one shop will no more apply to another than a time card for one division can be made to apply to another. A schedule once made must be carefully followed, or one gang or machine will be crowded with more work to be done at one time than it is possible to accomplish.

Locomotive schedules bear the same relation to getting work through the shop that time cards do to getting trains over the line. Every possible effort should be made to live up to the schedule, but when something goes wrong, the despatcher in the case of trains, or the general foreman in the case of the shop, must take a hand, make new meeting points, or devise new methods, hold some work back and advance other; in fact, take whatever action is necessary until the business is straightened out again.

It is no more possible to keep every engine in a big shop moving on schedule time than it is to keep every train between New York and Boston on time. If it is found that locomotives are continually behind schedule, it may be due to two causes: first, the schedule may be too fast; or second, something may be wrong in the shop that needs straightening out.

A schedule of any kind is of very little use unless some real and earnest effort is made to live up to it.

Equipment

The equipment of railroad shops is an important factor with respect both to efficiency and output. It is not efficient to continue in service, machine tools which have long since outlived their usefulness. A few conditions noted on a trip over a railroad which operates about 1,500 locomotives will, perhaps, explain more clearly than any other method of discussing the situation, the conditions I have in mind which must be given attention if we are to reduce shop costs.

The principal shop is an old structure that has been added to from time to time, and has no modern facilities or crane service. Locomotive driving wheels are removed on drop

pits in the shop. On account of the length of the shop, when removing wheels from 2-10-2 type locomotives, they are moved over the pit and spotted with the shop locomotive, and two pairs of driving wheels are removed. The locomotive is then taken out of the shop to the roundhouse turntable about 150 yards distant and turned around, returned to the shop, and the other three pairs of driving wheels are removed. To handle these wheels requires all the men that can get around them. In re-wheeling the locomotive the same process is followed; that is, three pairs of wheels are applied to the locomotive, it is then taken to the roundhouse turntable, turned around and returned to the shop so that the other two pairs of drivers may be applied.

At another shop on the same railroad, in checking the movement of parts of locomotives from the stripping pit, it was found that the driving boxes, rods, cross-heads, driver brake rigging, springs, hangers, etc., are trucked through the entire length of the shop to the lye vat, a distance of 700 feet, and then distributed to the respective places for repairs, and finally returned to the point they started from. This movement of material which is trucked through a congested shop could be eliminated by placing the lye vat at the stripping pit and in re-grouping some machines in the shop.

The driving boxes move 1,900 feet from the stripping pit until returned finished. This could be reduced to 400 feet by re-grouping the machines.

At various other points on the same railroad, we found repairs being made with the following obsolete machinery:

Wheel lathe, which was installed in 1878, on which it requires seven hours to bore a driving wheel tire which could be done with a modern, heavy duty boring mill in 30 minutes.

Tender truck wheels being turned on a 36-inch engine lathe in which but one tire can be turned at a time; therefore, the operation is very expensive. It requires five hours to turn tires which on a modern, heavy duty wheel lathe could be turned in 30 minutes.

Crown brass turning machine, built in 1861, which is entirely unsuitable for doing this work.

Wheel lathe, date of installation not obtainable, but is very old and requires seven hours to turn one pair of driving-wheel tires and six hours to turn one pair of engine or tender truck wheels.

Wheel lathe, old type, which requires six hours to turn one pair of 50-inch driving wheels, and four and one-half hours to turn tires on one pair of engine or tender truck wheels.

Wheel lathe, which was placed in the shop in 1879 and was second-hand at that time. On this machine it requires from three and one-half to four hours to bore one driving-wheel tire.

At another point locomotives are used to haul a transfer table, and this practice has been in existence for about six years.

Planers of different sizes, built in 1864 and in 1867. These machines have but one cross rail head and no side head, and are entirely unsuitable for present-day requirements.

On a mountain railroad with over 100 locomotives, a large percentage of which are Mallets, there is no wheel lathe. Tires are removed from the wheel centers and turned on a boring mill, and when necessary to turn the journals the wheels are pressed off the axles and the journals turned in an engine lathe.

This list could be added to, either on this same railroad or by going to any one of a number of others where this is fairly representative of their shop conditions, and when we consider that these and other similar machines must be used to maintain some of the heaviest, modern locomotives now in service, we will realize what some of the mechanical departments are up against in their efforts to maintain equipment.

Modern appliances are an absolute necessity, and it seems a shame that some of the up-to-date shops should be filled with hopelessly back-number machinery. In such cases, aside from improved facilities for handling, no decrease in the cost of machine work and no adequate output can be expected, and a road with such equipment will require a greater investment in motive power and cars to handle the business. The principal question is not how many locomotives a road has, but how many good, serviceable locomotives, and this depends entirely upon the facilities for repairing them and keeping them in service.

Next to the machine installation, it seems to me that the problem presented in shop operation which is most deserving of study is the question of transportation of parts; traveling cranes, mono-rail runways and jib cranes are wonderful factors in efficient shop operation.

Manufacture of Parts

It is usual for railroad shops to purchase some material and manufacture other. In some shops, the manufacturing of material is a large portion of the work done. In others, the material purchased much outweighs the material manufactured. Of course, shops, generally speaking, are repair plants and not manufacturing establishments; therefore, if we are to manufacture material or parts, I believe that a sharp line should be drawn as between material or parts to be purchased and material or parts to be manufactured, and having decided what is to be manufactured, prepare to do it in an economical and efficient manner.

The railroads have not as a general rule organized their mechanical departments on a manufacturing basis, but have depended upon outside sources for the majority of their manufactured products and such shop facilities as they have maintained have been largely for repair and maintenance work. Because of the diversified products of the ordinary railroad repair shop of today, the question of production has not been given the consideration it has in other fields. On some railroads, a start has been made towards the introduction of manufacturing methods by the establishment of centralized shop facilities which act as manufacturing plants for such commodities as can be distributed to outlying points where facilities for economical manufacture are not maintained. Such work, however, has usually been carried on as a side line at the largest repair shops on the individual roads. On this basis, it has been found economical to install special machinery and methods at a centralized point and manufacture pieces in quantities for storehouse stock to be distributed on requisition to the smaller shops or terminals over the system.

It is hardly to be expected that in railroad work, it will be possible to introduce the methods used in automobile manufacture or kindred lines, but it should be quite possible profitably to produce parts used in sufficiently large quantities at a centralized shop or manufacturing plant. Inasmuch as the finished parts for locomotives and cars are not designed to be absolutely interchangeable, either in design or manufacturing tolerances, it is necessary for the most part to provide sufficient latitude to permit of the final fitting of each piece at the point where application is to be made.

During the past few years, great improvement has been made and is being made in the design of machine tools and special machinery for railroad shop work. The installation of automatic and semi-automatic machinery adapted for railroad shop uses has been extended. The introduction of modern high capacity and special machinery into railroad shops has not always been an economical procedure, however, because of the fact that the output of the shop, where installed, has not been particularly adapted to the machinery, or because in the average shop such machinery can only be used a part of the time for the purpose to which it is par-

ticularly adapted. If parts are to be manufactured on a substantial scale, it could probably best be accomplished thrrough the establishment of centralized manufacturing shops equipped with up-to-date machine tools and shop equipment, with particular attention to automatic and semi-automatic machines for the production of locomotive and car parts in quantities.

One of the most important factors in the successful operation of a centralized shop for manufacturing purposes is the relation between the mechanical and storehouse departments. In order to derive the maximum or even satisfactory results from such an organization, it is essential that the shop be organized for quantity production on requisitions originating with the stores department; otherwise, we would be apt to have duplication of unnecessary parts and an accumulation of expensive manufactured parts which represent obsolete designs and have no value other than scrap.

With increasing cost for material and labor, it will be necessary to reorganize railroad shop facilities with a view to keeping equipment maintenance costs within reason; therefore, modern methods of shop production should be applied to railroad work in a much greater degree than is prevalent today. Locomotives and cars should be looked at from the viewpoint of a large investment, the productivity of which increases in exact ratio to the percentage which is available for service. It is usually estimated that the locomotives on a railroad represent approximately eight per cent. of the total cost of the property, but it is this eight per cent. which makes the other 92 per cent profitable, so that even assuming that by suitable shop facilities and efficient shop operation we are able to reduce our percentage of unserviceable locomotives from 12 per cent to 10 per cent, we have done more than the percentage figures indicate since the amount of transportation which can be furnished is represented by the number of serviceable locomotives.

Steel Car Repairs

While it is true that there has been failure in many instances on the part of railroads to provide locomotive shop facilities, the situation is even worse so far as steel freight cars are concerned, and with the exception of a very few railroads, practically nothing has been done along the line of facilities for the repair of steel freight cars. Where these facilities are provided they are, as a rule, of the most meagre character; frequently home-made furnaces, which result in extravagant consumption of fuel, totally inadequate equipment of clamps, formers, etc., worn out pneumatic tools, an insufficient supply of compressed air and, in a great many cases, actual shortage of repair material is found to exist.

Hundreds of thousands of rivets are being cut by hand which could be cut by proper pneumatic appliances in a fraction of the time. With proper buildings, proper equipment and a sincere and determined effort on the part of those responsible, the steel car plant can and should be as well organized and as efficient as any portion of our repair facilities. It can be made so only by presenting to the proper officers, a list of needs, clearly showing the saving which will result from their installation and, if they are installed, by making efficient use of them. The only locomotive and the only car that earns revenue is the serviceable one.

Do not understand this as a criticism of the men in charge of the mechanical departments on the various railroads except as it may be considered a criticism of their failure more aggressively to urge that adequate facilities more promptly and economically to repair equipment be provided. Neither is it intended to make us dissatisfied with what we have, because all must realize that we must do the best we can with existing facilities.

It is rather intended to be an outline of existing conditions and is given for the purpose of directing attention to the importance of formulating and following a definite and progressive policy of railroad shop improvement, because under the changed conditions which confront the railroads at the present time, with respect to labor costs, if we are to keep shop costs within reason, efficient and adequate facilities in the way of improved shops and shop equipment, particularly machine tools, must be provided.

The Great Northern Railway of Russia

By Kenneth Durant

A CONCESSION for the building of the long projected Great Northern Railway in Russia was granted recently to a Norwegian-American syndicate, according to information transmitted to the Department of Commerce by Norman L. Anderson, the American trade commissioner at Stockholm.

The "Svensk Handelstidning" of Stockholm recently reprinted an official report of the franchise from the "Severnaya Kommuna" (Northern Commune), of Petrograd, stating that the constructing syndicate was backed by American capital, and mentioning the name of "Hannevig"—well known in Norwegian financial and commercial circles—as one of the principals. The report adds, in conclusion, that if this group does not assume the undertaking, the concession will be offered on the international financial market.

The Great Northern Railway, which is essential to all plans for the development of the great natural resources of North Russia, was planned and its immediate construction urged by a special commission created under the Russian Ministry of Ways and Communications in 1916 for the purpose of outlining the whole railroad program of the Russian Empire. The commission was headed by the assistant minister of ways and communications, I. N. Borissov. At that time the traffic on the Siberian lines was growing at the rate of 20 per cent annually and the entire railroad system of Russia was suffering from rapidly increasing congestion. The commission reported that the construction of several new trunk lines, equipped for heavy traffic was immediately essential if the economic development of the country was not to suffer serious interference. The commission outlined an extensive program of railroad construction, which included the building of 4,150 miles in the five years 1917-1821, with an additional 1,400 annually during the succeeding five years. (This estimate left out of account special lines urged on the grounds of strategic necessity.) The whole program called for the construction of between 28,000 and 30,000 miles of railway between 1917 and 1926. If this plan had been realized, Russia would have between 70,000 and 75,000 miles of railroad by 1927; still greatly less, of course, than the railroad mileage of the United States in 1914. The plans outlined by the commission would have given Russia only 4.5 miles of railroad per 10,000 population and only 9.4 miles per 1,000 square miles of territory. The budget for materials and labor necessary for this program was estimated by the commission at $600,000,000.

Among the roads recommended for immediate construction by this commission was the Great Northern Railway, running north of, and parallel to, the Trans-Siberian railroad, and designed to relieve the heavy traffic on the latter and to stimulate the development of the vast coal and mineral resources of the Urals.

The Great Northern Railway is planned to run from Soroka, a station midway on the Murman Railway, near the Gulf of Onega, via Kotlas, a town on the Dvina river, thence across the Urals, and so on to the junction of the Obi and Irtish rivers in Siberia. From Kotlas it is proposed also to run two main lines to Zvanka, where the Murman Railway joins the Petrograd-Vyatka-trans-Siberian line, or else to run

past Zvanka directly to Petrograd. In addition there are planned shorter spur lines into important industrial districts. In all, the project represents about 2,000 miles of railway.

The concession first comprises the construction and operation of a Russian standard gage (5 ft.) road for general traffic. In addition the contracting syndicate secures the right to exploit about 22,000,000 acres of Russian forest. Of this about 5,500,000 acres are for the needs of the constructing company for a term of 80 years, the net profits from whatever mills and factories the company may establish to be included in the surplus of the railway. The remaining 16,500,000 acres of forest are given to the company for 48 years with the right to fell the whole district. Besides the forest concessions, the constructing syndicate is given the right to exploit all live mineral lodes found on examination of the lines. The company also has the right to establish and run shipyards, ports, and steamship lines, and will be given, free of charge, districts suitable for the establishment of towns and villages. Further, it may use all water power in the neighborhood of the railway. All such undertakings are considered a part of the railway enterprise.

In return the Russian Soviet Republic is to be paid one half kopeck per pood (36 lb.) for ore mined, without regard to the kind of ore; and will collect a charge of 5 per cent of the London market price on all timber cut. The company is relieved from income and industrial taxes, paying, instead, 25 per cent of its net profit.

The road, should it be built, would be of incalculable importance to the future development of North Russia, bringing transportation for the first time to the vast mineral, coal, timber, petroleum and agricultural resources of North Russia.

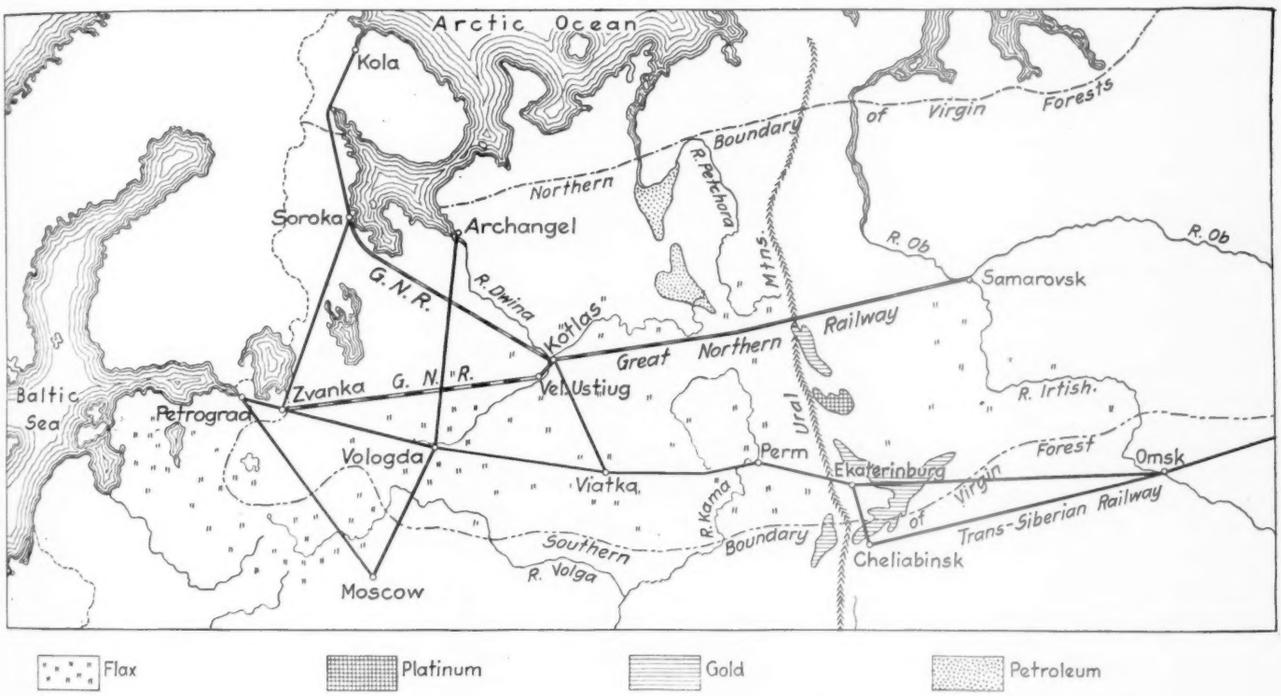


Diagram Showing the Proposed Great Northern Railway and Its Relation to Russia's Present Railways

Farmers Would Build Railway.—The farmers of Lake St. John, Canada, are applying for a provincial charter to build and operate their own railway through the entire region, covering several hundred miles and giving the remote districts of the north an outlet on the gulf board of the St. Lawrence, probably at the mouth of the Saguenay river.

Relation of Freight Charges to Values of Commodities*

By Julius Kruttschnitt

Chairman of the Executive Committee and President of the Southern Pacific Company

As the general impression of the relation of increases in steam railroad freight rates to the present high values of commodities is greatly exaggerated, the time seems peculiarly opportune to place some computations before you which show that transportation charges have played but a small part in lifting commodity prices to their present unparalleled level. This erroneous impression has been inspired and fostered by public speakers, by representatives of organized labor and by others, due we believe almost entirely to ignorance of the slight influence of freight charges on costs of commodities. The cumulative effect of all steam railroad freight charges, which in their remotest ramifications could affect the values of commodities, for the year 1914, which marked the opening of the war, has been weighed, and the same has been done for 1919. As we seek to establish the comparative effect of freight charges on commodity prices in two periods, six years apart, the Commission's methods used in computing tonnage and revenue statistics and ours in establishing prices being the same in both periods, will not affect the soundness of our conclusions.

	1919	1914
Average commodity value per ton of "freight originated" dollars	119.00	56.00
Freight charges per ton originated, dollars	2.80	2.00
Ratio of charges to value, per cent	2.4	3.6
Increase in cost to consumer, 1919 over 1914, dollars	63.00	.....
Increase in freight charges per ton, dollars	0.80	.....
Relation of freight increase to cost increase, per cent	1.3	.....

In other words, only 80 cents out of $63, or 1.3 cents out of every dollar of increase in value of commodities in 1919, was caused by increased freight charges; the responsibility for the remaining $62.20, or 98.7 cents out of every dollar,

*A letter to Hon. John J. Esch, chairman of the committee on interstate and foreign commerce, House of Representatives.

must be sought elsewhere; it was not caused by freight charges.

So many commodities originate on railroads, the values of which are affected by freight charges, some exerting substantial and some exerting negligible influence, that their influence on commodity values in individual cases cannot satisfactorily be computed, but the relation that the nation's entire yearly freight bill bears to the value of all commodities transported by the railroads can be satisfactorily and accurately measured.

In the year ended June 30, 1914, the Interstate Commerce Commission reports show that all Class I and Class II steam roads in the United States originated 1,094,123,895 tons of classified freight, (tonnage of Class III roads that earn less than $100,000 per annum, whose aggregate freight revenue is but 0.53 per cent of the total, is not reported by the Commission), for transporting which the carriers collected $2,114,697,629, an average of $1.93 per ton; they also received $75,541,569 express revenue for transporting additional tonnage of unknown amount; nevertheless, we have added express revenue to freight revenue without any addition to aggregate tonnage or values, thereby increasing the average freight charge per ton from $1.93 to $2, and the percentage of freight revenue to commodity value from 3.4 to 3.6. The 1,094,123,895 tons are classified by the Commission under 38 heads, to which appropriate unit values, based on data obtained from publications of the United States Department of Labor, from the United States Railroad Administration, from quotations in the press and from other reliable sources, have been assigned.

The aggregate value of all tonnage originated and transported by the railroads, thus determined, is $61,482,000,000 (*does not include the value of express tonnage, which is unobtainable*), which, divided by the number of tons originated, gives the average value per ton of all commodities $56, to which the $2 freight charge bears the relation of 3.6 per cent.

Under the heading of "tons originated," the Interstate Commerce Commission includes every ton of freight that originated on the lines of the carriers. A ton originating at San Francisco, for example, and shipped through to New York is counted as but one ton, regardless of the number of carriers over whose lines it passes. Freight and express revenues as reported by the Interstate Commerce Commission include all freight and express charges accruing both before and after manufacture. No transportation charge, however small or remotely affecting the cost of either a raw or of a manufactured article, can escape detection and inclusion in aggregate freight and express charges.

Year	Bradstreet's index No.		Ton mile rate (cents)	
	Actual	Relative	Actual	Relative
(1)	(2)	(3)	(4)	(5)
1899	7.21	100.00	.724	100.00
1900	7.88	109.35	.729	100.69
1901	7.57	105.06	.750	103.59
1902	7.88	109.24	.757	104.56
1903	7.94	110.07	.763	105.39
1904	7.92	109.83	.780	107.73
1905	8.10	112.33	.766	105.80
1906	8.42	116.75	.748	103.31
1907	8.90	123.50	.759	104.83
1908	8.01	111.09	.754	104.14
1909	8.52	118.10	.763	105.39
1910	8.99	124.66	.753	104.01
1911	8.71	120.85	.757	104.56
1912	9.19	127.42	.744	102.76
1913	9.21	127.71	.729	100.69
1914	8.90	123.49	.733	101.24
1915	9.85	136.66	.732	101.10
1916	11.83	164.01	.716	98.89
1917	15.66	217.15	.723	99.86
1918	18.73	259.84	.862	119.06
1919	18.11	251.21	.986	136.46

We have had to estimate data for the entire year 1919 from those that have already appeared for the first six months, and as the estimated traffic is substantially the same as that of 1916 we have applied 1919 prices to the tonnage of classified commodities of 1916, whence the average value per ton is $119, or 112 per cent more than that of 1914. Freight charges per ton, including express charges received by the carriers, are found to be $2.80, or 40 per cent more than in 1914. From this it appears that the relation of average freight charges to the average value of commodities, because of the more rapid rise in values than in charges, is less in 1919 than it was in 1914.

The preceding table shows the relation of average freight rates to values for the past 21 years. Column 2 gives Bradstreet's Index Numbers of commodity prices, Column 3 reduces these numbers to the basis of that of 1899. Columns 4 and 5 give actual and relative average ton mile rates.

The following will be observed:

From 1899 to 1900: Rise in prices 100 to 109.35, freight rates substantially unchanged. From 1907 to 1908: Fall in prices 123.5 to 111.09, rates substantially unchanged. From 1908 to 1912: Rise in prices 111.09 to 127.42, fall in rates. From 1915 to 1916: Rise in prices 136.66 to 164.01, fall in rates. In 1916 and 1917 prices were *higher* and freight rates *lower* than at any time in 19 years. From 1918 to 1919 a fall in prices of 259.84 to 251.21 and a sharp rise in rates.

The New York Sun, August 31, 1919, gives Dun's index numbers of living costs for each of the first seven months of 1919. During this period freight rates were unchanged; nevertheless, the index number for August is 10.4 per cent higher than in April.

In the case of imports that reach our shores unaffected by domestic freight charges, the slight influence of freight charges on their selling prices is ascertainable. For example:

Commodity	From	To	Miles	Freight per 100 lb.	Value per 100 lb.	Per cent frt. to value
Brazil coffee,	New York,	Pittsburgh	444	$0.27	$20.50	1.30
Japan rice,	New York,	Pittsburgh	444	.225	13.00	1.70
Japan tea (Yg. Hyson),	New York,	Buffalo	440	.60	65.00	0.92
Japan tea (Breakfast),	New York,	Buffalo	440	.60	34.00	1.80

California oranges have at times been bought by the box in the East *at the California price.* Prices of cantaloupes by the case are shown in the United States Department of Agriculture review of Imperial Valley, cantaloupe crop of 1919, as follows:

PREVAILING MARKET PRICES—(BOX OF 45s)

	San Francisco	Miles from Imperial Valley	N. Y.	Miles from Imperial Valley
July 1	$3.10	700	$2.75	2,580
2	3.35	700	3.35	2,580
5	3.25	700	3.35	2,580

In dealing with the almost numberless commodities embraced in a total of over a billion tons, it is impossible, in casting up "average commodity value per ton of freight originated," to assign to each its exact influence, although great care was exercised in selecting unit values. Criticism of our investigation in some direction is perhaps unescapable, but as the relation of commodity values in 1914 to those of 1919, computed by us, is 100 to 212 and that of the United States Department of Labor, published in the Labor Review of July, 1919, is 100 to 210, we feel that the close coincidence of these figures strengthens our confidence in our computations and conclusions, which we believe are free of substantial error.

A JAPANESE COMMISSION of railway and civil engineers is now in Mexico for the purpose of making a study of the topography of the Isthmus of Tehuantepec. This has given rise to reports that Japanese interests will build a railroad across the Isthmus. Recently it was announced that Japanese merchant ships were making Salina Cruz, on the west coast of Mexico, a port of call. Japanese settlers are said to be entering through this port. The only present railroad across the Isthmus of Tehuantepec is owned by British capital, but is controlled by the Mexican government.

Maintenance of Way Painters Convene at St. Louis

Propose Vocational Training and Labor Saving Equipment to Offset Shortage of Workman

THE SIXTEENTH ANNUAL CONVENTION of the Maintenance of Way Master Painters' Association, which was held at St. Louis, Mo., on October 23, 24 and 26, was devoted for the most part to a discussion of ways and means of overcoming the prevailing shortage of skilled painters. As a means to this end, the spray process was accorded the most interested discussion, but considerable attention was also given to a paper on the employment of painters the year round as a means of attracting and holding a better class of workmen, and to an address on the need of vocational training to replace the abandoned apprenticeship system. Other papers were devoted to further matters of direct application to the special problems of the trade. G. W. Thompson, Research Laboratories, National Lead Company, Brooklyn, N. Y., presented a paper entitled "The Limited Palette," in which he demonstrated that a wide variety of colors and shades could be obtained by the intelligent mixing of a few basic colors. Martin Kane, bridge and building master, Delaware & Hudson, Albany, N. Y., recalled the work of the grainer, which was once so popular and pointed to a number of modern tendencies that were leading to a revival of graining as a surface treatment. F. C. Rieboldt, master painter, Chicago, Milwaukee & St. Paul, Milwaukee, Wis., outlined the precautions necessary to obtain good results in painting under extremes of temperature. H. B. Wilson, master painter, Bessemer & Lake Erie, Greenville, Pa., submitted a very complete list of tools and equipment required for all classes of maintenance of way painting together with a discussion of the requirements of the more important items in the list. Economy in the handling of tools was also subjected to a lively discussion.

The officers of this association during the past year were: President, H. E. Conrad, master painter, Pennsylvania Railroad, Huntingdon, Pa.; first vice-president, H. F. Jones, master painter, Cleveland, Cincinnati, Chicago & St. Louis, Wabash, Ind.; second vice-president, Ole Stubstad, master painter, Chicago & North Western, Winona, Minn.; secretary-treasurer, F. W. Hager, master painter, Fort Worth & Denver, Fort Worth, Tex.

Address of the President

The most pertinent feature of President Conrad's address to the convention at the opening session was his reference to the Plumb plan, which is presented in part below:

"I wish to make an appeal to the members of this association on the subject of loyalty to our employers. At the present time much propaganda is being spread for the Plumb plan of government control and it has many followers among the radical class.

"The most ordinary common sense, awakened self-interest and knowledge of human nature and human experience should quickly repudiate the fallacies inherent in this plan. The danger is that public thought will not be quickened to the situation, and through lack of understanding and organization, legislation may be forced through Congress by means of organized political pressure, backed by abundant funds for propaganda and lobbying, which will work irreparable mischief before the public is aroused to the peril. As to the labor unions, they are on trial before the public of this country, and they must cleanse themselves of their anarchistic elements or fall. Therefore, let each and every one of us, who believes in American institutions, in property rights, in orderly government, line up in opposition to those who wish to confiscate our industries and bring about a chaotic state in our government."

The report of the secretary recorded a net gain in membership of 11, giving a total of 82 members in good standing. Thirty members were in attendance at the meeting.

Below is given an abstract of three of the papers presented, together with the discussions following their presentation.

Keep Men Employed Throughout the Year

BY HARRY F. JONES

Master Painter, Cleveland, Cincinnati, Chicago & St. Louis, Wabash, Ind.

It is impossible to keep practical men by working them six months of the year and laying them off the other six. Under this system we are merely operating a trade school. The men we get are inexperienced. We spend our time during the summer trying to teach them, but some other industry gets the benefit, for when we lay them off in the fall we very seldom get them back in the spring. When the time comes to put on men we open up our trade school again and pay another gang of inexperienced men good wages to teach them the trade.

The problem of arranging the work so as to keep men employed throughout the year would be a very small job for the master painter were he allowed to do so. My system of handling the work is as follows: We do our road work as early in the spring as possible, using motor cars and men enough to finish it in as short a time as possible. Consequently, we do not drag it along in the middle of the summer, using valuable time and weather that should be used to better advantage on other work. After completing the road work we give the steel work the attention it should have. I think steel structures should be taken care of during the warm months of the year. My experience has been that we get better results—a better job of cleaning and longer life of the paint.

After completing the steel I start the station work, doing the exterior work first, leaving interior work wherever possible for winter months, especially all offices, interiors of shops, etc. During October we take care of all the glass requirements, replacing all broken glass, also reglazing all sash that require it.

The first of the year I make a schedule of the work to be done that year, showing the amount of labor and material that will be required to execute the work we have listed. We have been using this system for several years and I find it much better and more practical than the old way under which we had no system. We get a better class of work at less cost by keeping the men employed throughout the year.

Results Secured with Spray Painting

BY H. S. BIRD

Master Painter, Philadelphia & Reading, Philadelphia, Pa.

Spray painting is not of a recent origin. My first experience with it was in 1897. The machine was a rather crude affair, composed of a hand pump for compressing air into a storage tank, a receptacle for mixed paint and a hose with a nozzle attachment. The paint used was rather thin in character; owing to the low pressure obtained with a hand-

pump the heavier paints could not be used. Two men were required to operate this machine. The spray produced was of a cloud effect and as the operator received a large portion of the spray and inhaled a considerable quantity, the results were not at all satisfactory.

The modern spray machine is quite different. It is equipped with power air compressors which provide air at higher pressures and make it possible to use a heavier bodied paint, which is applied with considerable force and in a satisfactory manner. The nozzle or gun can be adjusted to a broad or fine spray, the broad spray being adapted to large flat surfaces. The finer spray can be adjusted to narrow surfaces and deep crevices which cannot be reached with a brush.

Some reports I have received from concerns using spray equipment complain of the heavy bodied paints clogging the nozzle. This may be due to many reasons other than the fault of the equipment. The pigment may not be thoroughly mixed, or an incompetent operator may be at fault.

Spray painting applied by an experienced operator is economical in more ways than one. He is not only able to cover a large surface in much less time than with brush work, but he has a greater reach, therefore saving in the moving of planks and scaffolds. He is also able to reach inconvenient places, thereby eliminating the erection of special scaffolds or rigging, which would be necessary in brush work. I find in some cases a saving in the labor cost of 80 per cent and in material of 30 per cent. This is no doubt true where a competent operator is employed, but in painting railings or lattice work it is the general opinion that the spray is wasteful of paint. This loss, however, is small in comparison to the saving in the cost of labor.

As to the permanence of coatings, this is a question which seems yet to be in doubt. Some report that the spray coatings seem to be equal to that of the brush method, while others are of the opinion that it is not as satisfactory as brushing the material thoroughly. This, of course, could be determined by making a comparative test.

Discussion

Several members raised a question as to the saving of 30 per cent of the material. One or two related some unsatisfactory results secured with the spray process, but upon inquiry by others it developed that these experiences concerned the use of home-made devices or to attempts to use the spraying machines without proper instruction or training. President Conrad stated that in painting some girders stored in a yard one man with a spray accomplished as much as five men with brushes, but he did not claim that this record could be equaled on all classes of work. He found the spray of particular advantage for close quarters, as on the inside of box girders, but felt that there was a considerable value in the thorough brushing of paint, which was not obtained with the spray process.

He also emphasized the necessity for thorough instruction of the workmen in the proper use of the spray; in his experience, the men were very much opposed to the machine at the start but became very enthusiastic about it after becoming accustomed to its operation. In answer to a question, Mr. Conrad said that he mixed a certain amount of turpentine with the paint to thin it, but had found it practicable to use straight lead and oil in the machine.

The general tenor of the discussion indicated a serious interest in the possibility of the spray process as the solution of the labor problem of the master painter. Several expressed a willingness to co-operate with the manufacturers in the development and application of this labor-saving device.

C. B. Lyons, representing the DeVilbiss Manufacturing Company, Toledo, Ohio, presented a lantern slide talk on camouflage spray painting in France and a general exposition of spray painting practice, which served to answer many of the questions which had been raised in the course of the preceding discussion.

Vocational Training

By D. Louis Ireton

Chairman, The International Trade Education Development Committee of the United States and Canada, New York.

The need for more and better trained workmen in the painting trade is recognized everywhere. The abandonment of the old-time apprenticeship system, and our dependence upon foreign trained or untrained brush hands has caused a great deterioration in the quality of the work, and a lowering of its standards, until now we find it very hard to attract ambitious boys and young men to the trade. Unless there is a great awakening among those directly interested and greater co-operation and support of some definite apprenticeship system by master painters and manufacturers of paint materials, we are bound to suffer the consequences.

Ever since the passing of the old apprenticeship system, little or no consideration has been given to providing a substitute, because in our rush for greater production, and the ease with which we obtained the foreign trained worker immigrating to our shores, caused us to forget and willfully neglect our own American youth, who were left to drift haphazardly into all sorts and kinds of blind-alley jobs that lead nowhere.

America is a great industrial nation and must in the future depend upon her own resources for supplying the necessary skill and efficiency. It can no longer rely upon the foreign trained product, as in the past, but it is our own American youth who must meet the new conditions, and right now is the time for us to adopt a system of training that will fit them for present emergencies, and for others that are bound to follow as additional demands are made upon us. This presents problems, the solution of which calls for the fullest co-operation of all trades.

It is generally recognized that in abandoning the training which was given by apprenticeship and falling in line with the trend towards specialization in modern industry our workmen became greatly handicapped. There is a vast difference between the mechanic trained in one operation and the craftsman who has been trained thoroughly for all operations. The industries still have need for workmen who are qualified to assume every part of the particular trade in which they are engaged, and this can be provided for only through a properly organized apprenticeship system, either in the shops or schools, where a trade is taught in its entirety and a definite standard of ability established.

We must meet the issue fairly and squarely and solve the problem through compulsory laws if need be, but let us put a stop to this vast waste that results from our present faulty system, which menaces the welfare of thousands of our youth and causes millions of dollars of loss to employers through the lack of efficient and properly trained workmen. Let us have trade schools that will not only extend vocational training, but also help in increasing civic efficiency.

The national government believes in this new and much needed form of education as very essential to the country in establishing standards of efficiency for all vocations. But you must bear in mind that no scheme of education is self-operating, and that your craft will not be represented in this broad and most liberal provision unless you personally take the initiative in your own locality and thereby show the necessity for training apprentices in your craft.

In conclusion, I would warn you of the great problems facing us, of the unrest among the laboring classes; of the dangerous propaganda and influence of agitators striving to obtain control of our labor element for personal gains. The demoralization of our laboring classes by this alien element

is far reaching, and its influence will be felt not only in our workshops but also in our homes.

We must have 100 per cent Americanism among our workers, and we must insist that in our system of education and training, and also in the utilization of our resources, we recognize and maintain a standard that will insure 100 per cent Americanism in our civic, social and industrial life.

Closing Business

Acting upon the suggestion of President Conrad, the date of the next convention was selected so as not to conflict with that of the Bridge and Building convention, and it will be held at Detroit, Mich., on October 5, 6 and 7, 1920. The annual election of officers resulted in the selection of the following officers for the coming year: President, H. F. Jones, master painter, Cleveland, Cincinnati, Chicago & St. Louis, Wabash, Ind.; first vice-president, H. B. Wilson, master painter, Bessemer & Lake Erie, Greenville, Pa.; second vice-president, Bert. E. Darrow, master painter, Atchison, Topeka & Santa Fe, Kansas City, Mo.; secretary-treasurer, and E. E. Martin, master painter, Union Pacific, Kansas City, Mo.

Operation of the New York Terminal District*

Export Freight Has More Than Doubled in Five Years, but Facilities Were Built Forty-five Years Ago

By J. J. Mantell
Terminal Manager, New York Terminal District

THE PORT of New York presents, I believe, the largest and most difficult freight handling problem in the world today. It has fifty miles of waterfront with berthing facilities for from 450 to 500 vessels; 90 per cent of these facilities are located on the Staten Island, Brooklyn and Manhattan shores, the remainder on the Jersey side. The percentage of piers equipped to handle freight direct from car to vessel is negligible. The carriers have provided accommodations at the rail-heads for 31 vessels; these piers, however, are principally used for storage and for the transfer of freight from storage and from cars to lighters and barges.

New York is essentially a lighterage port and differs materially from other large ports, both here and abroad, in that practically all of them have rail-head service more or less on the order of Boston, where direct deliveries are made from cars to steamships. Furthermore, within a radius of twenty miles of lower Manhattan reside one-tenth of the population of the entire country. When you consider the industrial needs of this population together with the large import and export tonnage handled, and the peculiar physical characteristics of the harbor, it will give some conception of the magnitude of the railroad facilities necessary and the expensive operation that must obtain to serve a community and a port of this kind.

Before attempting a description of the facilities including marine equipment and piers it might be well to give some data as to tonnage handled by the railroads. The total imports and exports of the United States for the fiscal year ending June 30, 1918, amounted to approximately 45,000,000 tons; 18,000,000 or 40 per cent was handled through the port of New York. As a comparison the Seattle district handled 5,400,000 tons, New Orleans 4,800,000, Philadelphia 3,000,000, Norfolk 2,800,000, Baltimore 2,250,000, San Francisco 2,300,000, Boston 2,200,000, Galveston 1,100,000 and Savannah 260,000 tons.

The daily average local handling is 6,000 cars. There are maintained for this purpose 95 freight stations with storage capacity for 4,000 carloads and team track facilities for 3,500 cars. Practically all of the stations in Manhattan and Brooklyn are what is known as "pier stations" served from car-floats. The movement to these latter stations via car-float is 2,000 cars daily and there originates at these same stations 1,400 carloads of outbound freight. Advantage is taken of cars made empty on car-floats for outbound loading and the surplus empties are returned across the harbor for forwarding. The direct rail station service on Manhattan and Brooklyn approximates 600 cars per day; the same traffic on the New Jersey side amounts to 800 cars per day and service to the industrial sidings in the territory amounts to 1,200 cars per day.

The fruit and vegetable traffic affords a very interesting study of the highly specialized character of one of the operations. There are 90,000 cars of fruits and vegetables handled to New York yearly and this movement is confined almost exclusively to two railroads, the Pennsylvania handling practically all the southern and the Erie the western business. The California fruit, arriving over the Erie, is not only delivered at its Duane Street pier station but is first unloaded and sorted, then displayed and auctioned on the premises, after which it is removed by the buyers. The southern movement over the Pennsylvania Railroad from the Virginia gateways is disposed of in like manner, except that the sale is conducted privately on the piers. Considering that this is a seasonal movement, some conception may be had of the demand made upon the railway facilities involved.

Of the export freight 90 per cent is handled at the Jersey shore terminals. With but very few of the steamships docking on the Jersey shore, it is necessary that practically all cargo be lightered to ship's side at steamship piers. To handle the lighterage business in the port the railroads maintain for ordinary freight 1,600 open and covered barges with a capacity of 12,000 carloads, 371 car-floats with a total capacity of 5,300 cars and a fleet of 134 tugboats for towing purposes. This is the fleet maintained under normal conditions but, of necessity, is augmented by charter when business is above normal. Export grain and tidewater coal is handled by special equipment, the export grain being handled by five elevators and one trestle, four of which have facilities for direct vessel loading. When steamers do not take full grain cargo it is handled to ship's side on special barges and there loaded by floating elevators. The carriers operate some 100 grain boats in this service. In the tidewater coal traffic there are 2,500 coal boats in use and during the past year 537,324 carloads of tidewater coal were received at the port of New York, aggregating 24,968,313 tons, of which 4,770,320 tons were destined and carried by water to New England points as far east as Boston, the latter figures being exclusive of that coal moved to this section on car-floats through New York harbor. The transfer of the fuel from car to boat is accomplished by 12 McMyler auto-

*Address before the New England Railroad Club, December 9, 1919.

matic dumpers having a ten-hour capacity of 250 cars each. There are also 13 old style coal trestles, the latter being maintained more as an emergency than for general daily use.

There are nine principal trunk lines serving the port of New York and with the exception of the New Haven, all maintain terminals on the New Jersey shore. The New York Central is the only line that enters Manhattan by rail; the freight movement via this route is confined practically to team track, industrial side track and inland station deliveries. Export as well as other domestic freight is routed over the West Shore road to the terminals at Weehawken on the New Jersey shore.

Between the Hudson river and the Palisades and Newark bay the carriers maintain tidewater yards through which the business for pier stations in Manhattan and Brooklyn as well as the interchange is handled over 50 float-bridges, some of these are electrically operated and capable of loading six floats per hour. In these yards there are maintained 70 covered and open docks for the accommodation of domestic and export lighterage freight. The covered docks have a storage capacity of 9,000 carloads of freight and storage has been developed on the ground in the various terminals for 20,000 carloads of rough freight. Local team tracks, freight stations and warehouse facilities are also maintained in these yards. The team tracks, local stations, lighterage piers and other warehouses are served from these yards, cars being regulated to the tidewater yards from the large classification yards which all railroads maintain on the west side of the Palisades and Newark bay, and which are connected to the tidewater yards through mile long tunnels, open cuts and bridges. The open docks are equipped with mechanical cranes, both electrically and steam operated, of the locomotive, Gantry, etc., type. In addition, the suburban passenger traffic of all lines but the New York Central, New Haven and Long Island discharges at stations in this highly congested territory.

West of the Palisades and Newark bay on the meadowland are located the general classification yards or break-up yards, which include receiving, hump or gravity classification and storage yards, some of which have a capacity as high as 7,000 cars. In addition to the purely rail operation, all the necessary facilities such as icing stations, car repair shops, transfer platforms and ground or open storage are provided. Here inbound trains are received and broken up, cars reclassified and held until such time as they can be accepted in the advance or tidewater tracks. The capacity of all yards in the New York district is 90,000 cars, the normal in and outbound daily movement is 25,000 cars. At times in the past year there have been as high as 65,000 cars held in this territory. The movement of the freight traffic requires 640 eight-hour switch engine shifts.

Handling Export Freight

It is noteworthy to mention some of the important features in the handling of export freight. The fluctuation in the number of available ocean bottoms, the uncertainties of scheduled arrivals causing congestion at the piers, and the necessity of proper time distribution of weight and measurement cargo for ship's side, require a highly specialized car and lighter handling. These factors coupled with the complicated requirements of the consular and customs departments of the different receiving countries, made necessary the institution of the ten day free time feature on export freight. To obviate the necessity for holding this cargo on wheels awaiting movement to vessels the railroads have provided the storage previously mentioned. This necessitates a second handling but increases the capacity of the port by that many cars and results in the saving of an inestimable number of car days. Single, double and triple deck piers, equipped with elevators and gravity conveyors, electric trucks, electric tractor trucks and trailers and various other mechanical devices are used in conjunction with this export lighterage operation. Local consignees also have the privilege of lighter service at any of the 114 equitably distributed public piers and bulkheads or at any place they may designate within the harbor. This is, of course, in addition to the deliveries made at the established freight stations.

Prior to and during the war the railroads developed berthing space alongside the various piers on the New Jersey shore to accommodate 31 vessels. The traffic intended for direct vessel loading was regulated from the interior in practically full cargo lots and was handled direct from car to steamer. There was as high as 104 steamers per month handled at these railroad piers with a resultant saving of barges, lighters, tugboats and expense. The tendency during the last few months has been against direct loading of this kind owing to the lack of teamways at certain piers to take care of a small amount of freight originating at New York City. This condition could no doubt be taken care of until such time as teamways were improved or provided by the lightering of the New York City freight to the Jersey shore piers; this freight would not amount to 10 or 15 per cent of the entire cargo.

Exports Doubled in Five Years

The export handling through the port of New York has doubled in the last five years. If New York is to retain its supremacy as the foremost port serious and immediate consideration must be given to its proper economic development, considering the port as a whole and not only that part which is under the jurisdiction of the city of New York and state of New York but, as well, the section on the Jersey shore. The pier development in New York is by no means modern, with the probable exception of the Chelsea district; practically all the piers from the Battery to this district were planned and built over 45 years ago, and with the exception of the extensions that have gone on from time to time these piers remain the same narrow piers as originally constructed, being from 60 to 95 feet wide. The slips are narrow and intended for the accommodation of the old type steamer. With two modern steamships in a berth there is little room for the accommodation of freight barges, and in many instances when steamers are taking bunker coal, with other barges alongside loading and unloading, it is impossible to shift out empty barges from the forward hatches. Railroad equipment is seriously delayed and it takes practically twice as long to turn over marine equipment today in comparison with the operation five years ago, with a resultant increase in expense to the carriers. The city must also give serious consideration to the fact that the ever increasing population increases the traffic that must be handled by the carriers, and that practically all of the railroad stations serving the city are pier stations municipally owned and are now being used to the utmost of their capacity. While many plans have been prepared by the different city administrations nothing definite has been worked out, nor has any start been made. There have been many plans for marginal railroads, interior freight stations and warehouses; most of them looked good from an engineering viewpoint but lacked the essentials of practical operation, did not comprehend the volume of business to be handled and made no provision for the future. To handle the present domestic business now handled by car-float and lighter to pier stations and to care for prospective increases in the business for the next 15 to 20 years would require several batteries of floatbridges taking up a considerable portion of the space available through the release of pier stations, and would tremendously increase the expense incidntal to the operation of an underground marginal railroad with its heavy overhead and heavy direct operating expenses, in addition to the switching expense necessary to serve the floatbridges, inland freight stations, team tracks, etc.

It is a question in my mind whether you or I will see the

day when the railroads can get away from the pier stations in New York, but it is certain most of them will be forced to make increasing deliveries of New York City freight at team tracks and stations on the Jersey shore. In fact, during the peak periods it is now necessary that some volume of the New York City business be handled on the Jersey shore. A vehicular tunnel has been planned by the States of New York and New Jersey to connect Manhattan Island and Jersey City, with the New York end to be located at Canal street and the Jersey City end at 12th street. The traffic which is now trucked via ferry will no doubt be diverted to the tunnel, but the full benefits of the proposed tunnel will not be felt until the railroads have money available for the further development of their Jersey shore properties. They will require additional freight stations, team tracks, warehouses, etc. The territory in Manhattan to be served by the tunnel is somewhat limited; I have in mind the large stretch of territory from the Battery to the Bronx, and in this connection the Brooklyn and Long Island situation. Further, the heavy interchange of cars between the New Jersey and New England roads should be via tunnel connecting Greenville and Bay Ridge under New York Bay. A tunnel of this kind would cost approximately thirty million dollars.

Heavy Cost of Terminal Handling

To emphasize the expensive operation at this port I might say that on many of the commodities handled the cost of the terminal handling from receipt of car at the outside classification yard to delivery in New York equals the operating cost of hauling cars from Buffalo to Pittsburgh to the terminal. This situation can be corrected by the development of facilities along the lines of economic handling with the co-operation of the States interested, the Federal Government and the railroads. The solution, I believe, is the development of two large clearing yards in New Jersey, one to the south and one to the north, to take the place of present individual classification yards. It would be necessary to have two clearing yards as one yard sufficiently large to accommodate the business of the port would be unwieldy in its handling. These yards could be connected by a belt line railroad; floatbridges could be centralized and the water front developed to provide multiple story steamship piers along the New Jersey shore from Greenville to Weehawken, a distance of approximately nine miles, the upper floors to be used for storage and the lower floor equipped with teamways and tracks for the handling of freight direct from car to steamer. Piers should be developed to suit the needs of the individual interests and so constructed as to provide for the handling of weight and measurement cargo at the same pier. Outside open tracks should be provided, where necessary and piers equipped with overhead cranes and various other mechanical devices, detailed description of which would take up too much time.

What is true of conditions in New York, in respect to modern facilities and mechanical devices, modern piers and adequate slip room between piers is also true of practically all the other ports in this country. We Americans have the inventive genius but we do not seem to apply it at home. New York and other American ports cannot be compared with some of the ports abroad, particularly Hamburg. The import and export freight of the United States is increasing in volume from year to year; the increase is more pronounced at the North Atlantic ports and there is at present some competition among the various ports for the handling of this business. To my mind the port that will get the greatest volume is the one that will economically handle freight, both from a railroad and a steamship standpoint in the way of effecting rail head deliveries and in the quicker turnover of steamships. The economy in handling can only be brought about by modernization. There is very keen competition in the steamship business and I have no doubt that steamers will naturally flow to that port where a quicker turnover of steamships will make it possible for steamship companies to increase the number of round trips made by their vessels during the year.

The Erie Commended

The Erie can be commended for its farsightedness in the planning and erecting, prior to the war, of a modern pier 1000 feet long, 100 ft. wide, at their freight terminals at Weehawken, N. J. On this pier are five railroad tracks and it is equipped with four electric traveling portal Gantry cranes which have a capacity of ten and twenty tons. These cranes operate overhead and the switching operations are carried on independent of crane operation. Ocean freighters are brought direct to this pier for loading direct from car to boat using the mechanical facilities of the pier in loading. This is a radical departure in cargo handling and the most modern unit in the harbor. The time consumed in loading ships with these facilities is about one-half of that consumed under the old method of unloading from cars to lighters and towing lighters alongside of vessels and arranging for special derricks to handle heavy commodities such as locomotive boilers, car parts, etc. The expense of direct handling from the pier is considerably less and there is twice as much freight handled than under the old method. This facility is fully described in the April 18, 1919, issue of the *Railway Age*.

I would like to degress for a moment to touch in a brief way upon some modern facilities at Norfolk, Va., and Seattle, Wash. The coal piers located at Norfolk and maintained by the Virginian, Norfolk & Western, and Chesapeake & Ohio R. R., are, I believe, the most modern to be found anywhere. When I visited that port not long since I was greatly impressed with the operation; the ease and facility with which the handling was performed brought forcibly to my mind the necessity for immediate modernization of all large freight handling ports. Steamers are turned over at these piers twice as quickly as is possible at New York and the expense of the operation is considerably less than at ports with less modern facilities.

The city of Seattle has given serious consideration to modern pier facilities. They have already made a good start in the construction of a modern pier, municipally owned; one-half of this pier is open and is equipped with stiff leg derricks and Gantry cranes. The open section of pier is on the land end and the steamship berths at that end to take on its weight cargo, moving backwards to the river end of the pier, which is covered and equipped for the handling of measurement cargo.

Speaking of pier development, New York has practically stood still for several years and with the exception of the development in the Chelsea district, which was more or less on the old order of pier construction, no recent improvements have been made. The city of New York has many plans and many others are being prepared for the development of Staten Island, where only a limited amount of freight can be delivered at rail heads. There are other plans for the development of Jamaica bay which contemplate the use of it as a distributing center for Brooklyn, Manhattan and the Bronx. Staten Island is approximately six miles from the center of lighterage activity and Jamaica Bay is approximately seventeen miles from the consuming and forwarding center of the city. You can readily appreciate that such a scheme is impractical. Any development along these lines should consider only the needs of the territory within a radius of six or seven miles. Manhattan, as well as the large New Jersey district, which is fast developing, should be taken care of by the modernization of the New Jersey shore front somewhat on the order heretofore outlined. Of course any development on such a large scale as that pro-

matic dumpers having a ten-hour capacity of 250 cars each. There are also 13 old style coal trestles, the latter being maintained more as an emergency than for general daily use.

There are nine principal trunk lines serving the port of New York and with the exception of the New Haven, all maintain terminals on the New Jersey shore. The New York Central is the only line that enters Manhattan by rail; the freight movement via this route is confined practically to team track, industrial side track and inland station deliveries. Export as well as other domestic freight is routed over the West Shore road to the terminals at Weehawken on the New Jersey shore.

Between the Hudson river and the Palisades and Newark bay the carriers maintain tidewater yards through which the business for pier stations in Manhattan and Brooklyn as well as the interchange is handled over 50 float-bridges, some of these are electrically operated and capable of loading six floats per hour. In these yards there are maintained 70 covered and open docks for the accommodation of domestic and export lighterage freight. The covered docks have a storage capacity of 9,000 carloads of freight and storage has been developed on the ground in the various terminals for 20,000 carloads of rough freight. Local team tracks, freight stations and warehouse facilities are also maintained in these yards. The team tracks, local stations, lighterage piers and other warehouses are served from these yards, cars being regulated to the tidewater yards from the large classification yards which all railroads maintain on the west side of the Palisades and Newark bay, and which are connected to the tidewater yards through mile long tunnels, open cuts and bridges. The open docks are equipped with mechanical cranes, both electrically and steam operated, of the locomotive, Gantry, etc., type. In addition, the suburban passenger traffic of all lines but the New York Central, New Haven and Long Island discharges at stations in this highly congested territory.

West of the Palisades and Newark bay on the meadowland are located the general classification yards or break-up yards, which include receiving, hump or gravity classification and storage yards, some of which have a capacity as high as 7,000 cars. In addition to the purely rail operation, all the necessary facilities such as icing stations, car repair shops, transfer platforms and ground or open storage are provided. Here inbound trains are received and broken up, cars reclassified and held until such time as they can be accepted in the advance or tidewater tracks. The capacity of all yards in the New York district is 90,000 cars, the normal in and outbound daily movement is 25,000 cars. At times in the past year there have been as high as 65,000 cars held in this territory. The movement of the freight traffic requires 640 eight-hour switch engine shifts.

Handling Export Freight

It is noteworthy to mention some of the important features in the handling of export freight. The fluctuation in the number of available ocean bottoms, the uncertainties of scheduled arrivals causing congestion at the piers, and the necessity of proper time distribution of weight and measurement cargo for ship's side, require a highly specialized car and lighter handling. These factors coupled with the complicated requirements of the consular and customs departments of the different receiving countries, made necessary the institution of the ten day free time feature on export freight. To obviate the necessity for holding this cargo on wheels awaiting movement to vessels the railroads have provided the storage previously mentioned. This necessitates a second handling but increases the capacity of the port by that many cars and results in the saving of an inestimable number of car days. Single, double and triple deck piers, equipped with elevators and gravity conveyors, electric trucks, electric tractor trucks and trailers and various other mechanical devices are used in conjunction with this export lighterage operation. Local consignees also have the privilege of lighter service at any of the 114 equitably distributed public piers and bulkheads or at any place they may designate within the harbor. This is, of course, in addition to the deliveries made at the established freight stations.

Prior to and during the war the railroads developed berthing space alongside the various piers on the New Jersey shore to accommodate 31 vessels. The traffic intended for direct vessel loading was regulated from the interior in practically full cargo lots and was handled direct from car to steamer. There was as high as 104 steamers per month handled at these railroad piers with a resultant saving of barges, lighters, tugboats and expense. The tendency during the last few months has been against direct loading of this kind owing to the lack of teamways at certain piers to take care of a small amount of freight originating at New York City. This condition could no doubt be taken care of until such time as teamways were improved or provided by the lightering of the New York City freight to the Jersey shore piers; this freight would not amount to 10 or 15 per cent of the entire cargo.

Exports Doubled in Five Years

The export handling through the port of New York has doubled in the last five years. If New York is to retain its supremacy as the foremost port serious and immediate consideration must be given to its proper economic development, considering the port as a whole and not only that part which is under the jurisdiction of the city of New York and state of New York but, as well, the section on the Jersey shore. The pier development in New York is by no means modern, with the probable exception of the Chelsea district; practically all the piers from the Battery to this district were planned and built over 45 years ago, and with the exception of the extensions that have gone on from time to time these piers remain the same narrow piers as originally constructed, being from 60 to 95 feet wide. The slips are narrow and intended for the accommodation of the old type steamer. With two modern steamships in a berth there is little room for the accommodation of freight barges, and in many instances when steamers are taking bunker coal, with other barges alongside loading and unloading, it is impossible to shift out empty barges from the forward hatches. Railroad equipment is seriously delayed and it takes practically twice as long to turn over marine equipment today in comparison with the operation five years ago, with a resultant increase in expense to the carriers. The city must also give serious consideration to the fact that the ever increasing population increases the traffic that must be handled by the carriers, and that practically all of the railroad stations serving the city are pier stations municipally owned and are now being used to the utmost of their capacity. While many plans have been prepared by the different city administrations nothing definite has been worked out, nor has any start been made. There have been many plans for marginal railroads, interior freight stations and warehouses; most of them looked good from an engineering viewpoint but lacked the essentials of practical operation, did not comprehend the volume of business to be handled and made no provision for the future. To handle the present domestic business now handled by car-float and lighter to pier stations and to care for prospective increases in the business for the next 15 to 20 years would require several batteries of floatbridges taking up a considerable portion of the space available through the release of pier stations, and would tremendously increase the expense incidntal to the operation of an underground marginal railroad with its heavy overhead and heavy direct operating expenses, in addition to the switching expense necessary to serve the floatbridges, inland freight stations, team tracks, etc.

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The city of Seattle has given serious consideration to modern pier facilities. They have already made a good start in the construction of a modern pier, municipally owned; one-half of this pier is open and is equipped with stiff leg derricks and Gantry cranes. The open section of pier is on the land end and the steamship berths at that end to take on its weight cargo, moving backwards to the river end of the pier, which is covered and equipped for the handling of measurement cargo.

Speaking of pier development, New York has practically stood still for several years and with the exception of the development in the Chelsea district, which was more or less on the old order of pier construction, no recent improvements have been made. The city of New York has many plans and many others are being prepared for the development of Staten Island, where only a limited amount of freight can be delivered at rail heads. There are other plans for the development of Jamaica bay which contemplate the use of it as a distributing center for Brooklyn, Manhattan and the Bronx. Staten Island is approximately six miles from the center of lighterage activity and Jamaica Bay is approximately seventeen miles from the consuming and forwarding center of the city. You can readily appreciate that such a scheme is impractical. Any development along these lines should consider only the needs of the territory within a radius of six or seven miles. Manhattan, as well as the large New Jersey district, which is fast developing, should be taken care of by the modernization of the New Jersey shore front somewhat on the order heretofore outlined. Of course any development on such a large scale as that pro-

posed could not be undertaken by the railroads alone; to carry out a project of this kind it would require considerable financial assistance from the two states and the Federal Government. When you consider that a development along modern lines would undoubtedly reduce by 50 per cent the lighterage that is now perfromed and, proportionately, other terminal costs and would place the port on an economic basis to compete with the other American ports, it is very evident that some comprehensive development must be made if New York is to retain its present supremacy as the foremost American port. These are the questions engaging, our attention at the present time and they will be before us more than ever in the future.

A Word About Passenger Travel

My talk would not be complete without mentioning the enormous passenger travel in and out of the city; there are approximately 522,000 passengers handled in and out of the various passenger stations each working day or very nearly the population of the city of Boston. The flexibility of the terminal organizations will be appreciated when it is considered that for the war period, prior to November 11, 1918, in addition to the normal volume of business, 80 per cent of the total movement or 1,650,679 troops were moved through the port of New York to points overseas.

The following table will give an idea of the passenger movement as between the railroads and the different passenger stations:

NUMBER OF PASSENGER TRAINS AND PASENGERS IN AND OUT OF NEW YORK FOR ONE MONTH

Station	Railroads	Number of trains		Number of passengers	
		Inbound	Outbound	Inbound	Outbound
Grand Central Station, N. Y.	N. Y. C. and N. Y. N. H. & H.	5,648	6,101	1,384,376	1,443,336
Pennsylvania Station, N. Y.	Long Island	3,592	3,432	756,098	754,982
	PER L.V. & B.&O.	5,593	5,640	403,444	403,444
		9,185	9,072	1,159,542	1,158,426
Flatbush Ave., Brooklyn	Long Island	3,964	3,920	1,069,280	1,048,027
Jersey City	Erie	3,724	3,713	1,050,000	1,050,000
Jersey City	C. R. R. of N. J.	3,814	3,684	821,272	836,668
Hoboken	D. L. & W.	2,874	2,955	875,195	900,359
St. George, Staten Island	S. I. R. T.	4,494	4,494	382,566	382,566
Jersey City	P. R. R.	2,172	2,230	309,680	330,460
Weehawken	West Shore	851	843	290,102	272,244
Total		36,726	37,012	7,342,013	7,427,066

Percentage of Trains on Time in September

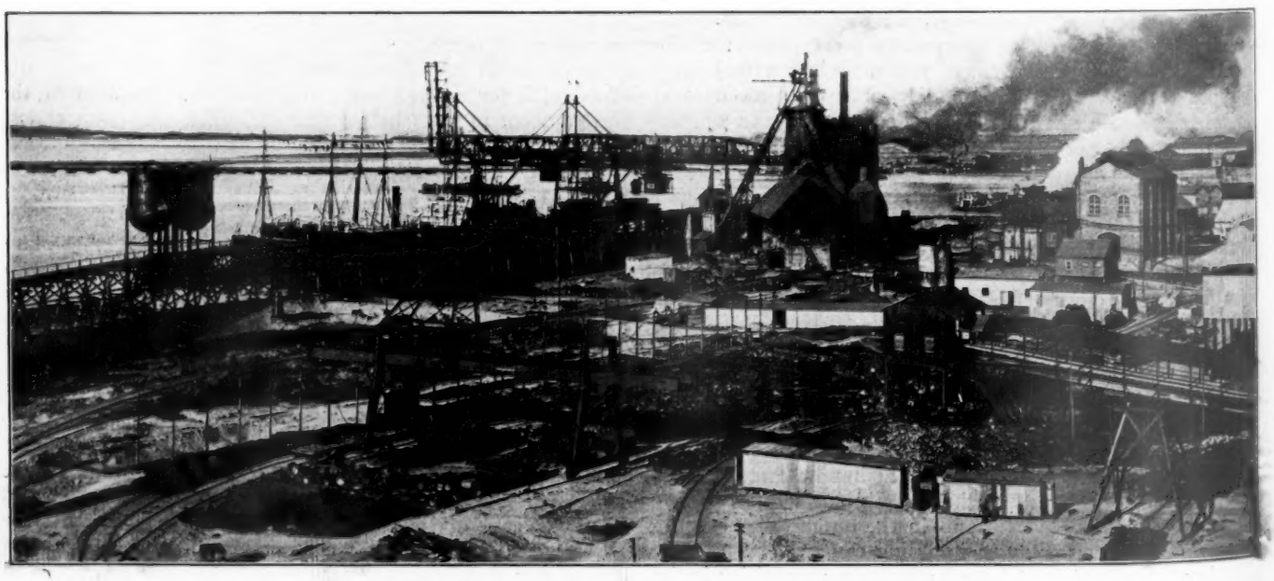
DURING SEPTEMBER an even higher percentage of passenger trains made on-time runs than in August, according to a statement issued by the Railroad Administration, although the results in August were adversely affected by various unauthorized strikes of shopmen. Figures compiled by the Operating Statistics Section show for the month for all regions that an average of 84.3 per cent of the passenger trains arrived at their terminals on time, compared with 83 per cent in August. Including trains leaving initial terminals late because of delay to connections, 88.1 per cent made their runs in schedule time or better, compared with 87.3 per cent in August.

In the Southern region, comprising 33 roads, on which 48,905 passenger trains were operated in September, 43,216, or 88.4 per cent, arrived on schedule time, while 44,940, or 91.9 per cent, made their runs in schedule time or better.

The following compilation, covering all regions, embraces the Class 1 roads under federal control. Suburban trains are not included:

Region	Month	Number of roads	Total trains operated	Trains which arrived on schedule time: Number	Trains which arrived on schedule time: Per ct. of total trains	Trains which arrived on schedule time or which, if late, made run in schedule time or less: Number	Trains which arrived on schedule time or which, if late, made run in schedule time or less: Per ct. of total trains
Eastern	September.	43	95,972	80,985	84.4	83,598	87.1
	August ...	43	98,081	82,071	83.7	85,989	87.7
Allegheny	September.	15	77,523	68,745	88.7	70,700	91.2
	August ...	15	86,261	76,756	88.1	72,912	90.8
Pocahontas	September.	3	7,648	6,460	84.5	6,920	90.5
	August ...	3	3,970	2,949	74.3	3,073	77.4
Southern	September.	33	48,905	43,216	88.4	44,940	91.9
	August ...	33	49,683	42,224	85.0	44,668	89.9
Northwestern	September.	15	25,372	20,431	80.5	21,399	84.3
	August ...	15	25,960	19,939	76.8	21,064	81.1
Central Western	September.	24	42,312	32,412	76.6	35,485	83.9
	August ...	24	42,474	32,390	76.3	35,272	83.0
Southwestern	September.	23	20,010	15,459	77.3	16,792	83.9
	August ...	23	20,289	15,855	78.1	16,992	83.8
Average for all regions	September.	156	317,742	267,708	84.3	279,834	88.1
	August ...	156	320,718	266,184	83.0	279,970	87.3

In the foregoing trains arriving at final terminal 10 minutes late or less are considered on time. When considering time of departure, delays at initial terminal chargeable to causes other than waiting for connections are considered as part of running time. Delays at intermediate points waiting for connections are considered as part of running time.



The Broken Hill Steel Works at Newcastle, New South Wales, Australia

The Relation of Standardization to Progress

President of the Railway Business Association Presents Concrete Illustration to Congress

DURING THE HEARINGS before the House Committee on Interstate and Foreign Commerce, a number of manufacturers of railway equipment presented voluntary statements as to certain phases of the question of the disposition of the railroads at the expiration of federal operation. During their appearance before the committee these men were practically all asked for their opinions relative to standardization of railway equipment. In response to these questions the following letter was addressed to Representative Esch, chairman of the committee, by Alba B. Johnson, president of the Railway Business Association. The letter, which presents a concrete illustration of the part competition and initiative have played in the rapid development and improvement of railway facilities, is as follows:

Manufacturers of railway equipment upon concluding voluntary statements before your committee were asked by you their opinion regarding standardization. They replied that they favored interchangeability of car or locomotive parts through standardization of dimensions, but regarded it as essential to progress that there be variety of design and competition among inventors and developers of appliances.

Competition Essential to Progress

It is due to you and to ourselves that a fuller explanation of our view and of the reasons underlying it should be made. By conference and correspondence we have obtained the knowledge and judgment of members of our association and others. In the subjoined statement we endeavor to demonstrate that competition is essential to progress in service and in economy, that voluntary standardization by the railways acting collectively has long afforded and can continue to afford all desirable interchangeability, and that diversity of design is the indispensable condition for exertions by inventors and by developers of appliances. As bearing upon diversity of design, a description is given of a typical competitive appliance, the brake beam rigging. Authorities quoted in the statement are connected with the several concerns which make such rigging, and speak in response to our request.

As a factor in progress what is at stake is competition. If Congress adopts the principles set forth in Section 9 of the Cummins Bill (S. 2906), which deals with consolidations, the 20 to 35 ultimate systems will be so formed that 'competition shall be preserved as fully as possible.' The government determines rates, in which competition has therefore largely ceased. What remains is competition in service and economy.

Such competition in the past has been maintained between railways and between makers of devices. The makers' occupational motive for maintaining competition in both directions is self-preservation; but the public has a vital interest in the preservation of these manufacturing enterprises and in the continuance of competing railway systems, since upon such enterprises and such railway competition depends quality and cheapness of transportation performance.

From economical operation, the public benefits through larger railway income, stronger railway credit, more vigorous improvements of and additions to facilities and through a tendency to keep down rates.

Standardization means the elimination of competition.

Insofar as standardization is desirable for the sake of practical stability and convenience of repairs, the railroads themselves, with the co-operation of the manufacturers, have in the natural course of business adopted and employed it. A standard specification in vogue on American railways is not the edict of a potentate or board of potentates. It comes up from below. It must make its way into general approval before it can have the force of a regulation which the minority will observe. So far as the manufacturer goes, the matter of applicability, of usability, which is the same thing as interchangeability, is out of his hands without action of government.

For several decades the Master Car Builders' Association and the Railway Master Mechanics' Association (locomotive), scientific institutes of railway officers, have annually added to the appliances whose dimensions and requirements for performance are specified. These the American Railway Association, as it existed prior to government control, recommended to all the roads. Generally, they were put into effect as soon as announced.

The need of standardization of locomotives is almost wholly imaginary. A locomotive rarely leaves the road owning it or even the division for which it was built; hence in time of peace and almost entirely in time of war all locomotive repairs are made at home.

As to cars, interchangeability has been made universal in the United States. Accompanying this statement we present to your committee copies of two dictionaries issued annually by the Simmons-Boardman Publishing Company, publishers of the *Railway Age*, one dealing with locomotive appliances, the other with car appliances. The latter part of each book contains the standards referred to, with pictures and drawings. From these books your committee can derive a conception of the extent to which the railroads when occasion required have standardized voluntarily.

Fundamentals of Railroad Economy

To grasp the significance of the burden which a developing mechanical practice sustains in transportation progress, it is necessary to bear in the mind the fundamental of railroad economy.

In freight, the problem is the number of tons that can be hauled by one locomotive with one crew—in a word, the train-load. Possibly the largest single factor in the notable prosperity of such a road as the Union Pacific has been the success of the management in attaining heavy train-loading. It was in pursuit of this economy that the late Mr. Harriman gave his days to experiment and devoted hundreds of millions to capital improvements. For augmentation of train-load, railroads in all parts of the country which had been permitted to accumulate the investment basis have poured out expenditures. They have built larger and stronger cars. They have constructed more powerful engines to haul the larger cars and more of these cars to the train. They have provided heavier roadway, rails, and bridges to sustain the enormously more ponderous train and cargo.

These expenditures, by reducing the cost of drawing freight per ton per mile, not only paid for themselves, but so far offset the rising cost in wages and material as to postpone for years before 1910 the necessity for asking that freight rates be raised. The train-load as a foundation basis of railroading explains the despair of managers when employees proposed extra men in crews and a limit on length of trains.

Passenger trains have been made heavier also. More

persons are carried to the car. Steel has taken the place of wood for safety. Speed has been increased for convenience.

Development of Air Brake

To all this development there has been at every stage and in every phase a mechanical limit. For instance, the movement of the train must be controlled. The engineer must be able to slow down or stop in any emergency. That is to say, railways can progress in economy of operation no faster than the development of the brake. The air brake of the 60's replacing for more exacting uses the hand brake, achieved a stupendous advance; but stopping the toy trains of that era was to the stopping of the 100-car train of 125-ton loaded cars of today what the air brake of 1870 was to the air brake of 1919. Progress in the trainload and in the brake has gone hand in hand.

Even in the years when because of patent protection there was only one maker of air brakes, competition was an ever-present influence. First there was the competition between railways. The most progressive-minded of the managers were perpetually engaged in rivalry for cheaper operation. If practice had been standardized for all lines no departure cauld have been undertaken on any of them until the whole national system, perhaps a central omnipotent board, could be persuaded. Cars of a certain capacity would have been obligatory until all news cars for all lines contracted for after a specified date might be built larger. Territorial and topographical contrasts in conditions confronting the several lines might imperfectly and tardily be met. The working of this tendency in practice can be observed in the government standard cars allocated to some roads which had long since adopted larger capacity as best suited to their special problems.

Second there was the potential competition of makers who might bring out competing brakes sufficiently original to convince the patent office. A rival actually established itself, though it now in part covers its patent situation by a license arrangement. What kept one concern so long alone in the field was that it diligently developed improvements —in short, it acted as it would have had to act if competition had been actual instead of merely potential. A vivid form of potential competition was that of makers ready to enter the field the moment patent rights expired. To maintain its commercial position the single maker long before each such expiration abandoned the air brake of yesterday and substituted a new device, protected in turn by new patents. The public was benefited because the essential advantage which induced progressive railways to try and use the newer appliance was the net saving in cost of operation through enlargement of the trainload.

A significant feature of the standard vehicles built by the United States Railroad Administration was the effort, in some cases successful, to use an appliance upon which patent rights had run out and thus to exclude from the bidding more recent inventions still protected. From the point of view of the public this is penny wise and pound foolish. It attains a little immediate cheapness. In doing so it exterminates by starvation the breed of inventors whose work is to promote not alone little economies but great ones.

Brake Beam Standardization

An ilustration more typical than the air brake is its adjunct, the brake beam. In what follows it has been thought convenient to employ for concrete illustration one appliance rather than several. For this purpose the deveice selected is the brake beam. This appliance is attached both to locomotives and to cars. Rigid standardization of its dimensions and of its strength is necessary and is enforced. From six to a dozen types are in use, while unsolved problems with regard to it are today the object of study and experiment. A somewhat full description of this rigging will facilitate an understanding of subsequent references.

The air brake can develop no faster than the beam. For between the air cylinder, whose piston is operated by pressure initiated in the locomotive cab, and the metal shoe which in action is forced against the wheel, there is a mechanism which directly applies the power to the shoe. A failure of that mechanism puts the brake out of commission. The cylinder piston operates a rod located under the vehicle midway laterally, and by a system of levers moves the two, three or four trussed brake beam structures toward the pairs of wheels which they are to brake. The performance which is expected of the beam rigging is this: that it receive the cylinder power; that it move so that simultaneously the shoe, which is fastened to it, will be pressed against the wheel; and that it stand the strain.

It is in standing the strain—that is, the dependability and durability—that progress has been made and is still promised in the brake beam. If a manufacturer claims superiority for his type it is to those qualities that he refers.

The Master Car Builders' standards tell him how many inches the beam must measure from tip to tip and throughout its external outline in order to fit the various cars. They prescribe the height at which the beam must hang above the rail. They require specified dimensions and locations for certain parts of trussed structures. Consequently when a car off the rails of the owning road is found with a damaged brake beam and the road on whose rails it is sojourning is addicted to a beam of another type, the defective beam can be replaced by one carried in stock by the road which does the repairing.

The argument in favor of standardization is that while interchangeability of beams as a whole is maintained with variety of detail, each several part of the beam structure cannot be replaced by a part from another type of beam, but the whole beam must be substituted. Another view prevails. This is that serviceable and safe brake beam repairs are only made when the parts of the beam structure have been put together under the same tests and conditions as surround the manufacture, inspection and acceptance of new beams; whereas such conditions are not and cannot be presented on yard repair tracks. The discarded beam is not wasted. It is sebsequently carried to a place where under rigid conditions qualified mechanics restore it; and it takes its course of standard inspection like a new beam before it can again be placed on a vehicle.

In their requirements the Master Car Builders' Association includes loads that beams shall successfully carry; but the means by which the maker shall impart the specified power of resistance to the beam and its parts is within his own province. That is, the field in which progress lies.

The original brake beam was wooden. As trainloads began to enlarge it was seen that a wooden beam strong enough for the new conditions would be a monstrosity in size. C. F. Huntoon writes that "the best design of truss metal beam 15 years ago weighing approximately 63 lb., carried a load of 6,500 lb. at 1/16-in. deflection, this deflection being the maximum allowed by the M.C.B. Association, while today a beam of 77 lb. weight, or 20 per cent increase, will carry a load of 15,000 lb. at 1/16-in. deflection, an increase of over 125 per cent in strength and efficiency." Mr. Huntoon attributes such progress "to specialists who have directed their efforts to some one device or detail—each vying with the other to produce an article of superior merit" and he says, "without this competition and the protection afforded by letters patent, there would be no fast schedule trains and boats, no telephones on the desk or automobiles for convenience or pleasure; in fact, the industrial progress of this country has been stimulated by and is largely due to these very factors."

The advance proceeded through various forms in metal. At first light metal beams met the situation, beginning with

a trussed structure of pipe. Further increase in train weights led from year to year to development of more adequate trussed brake beam structures by various manufacturers, differing in the various parts, most notably in the "beam" or "compression" part proper—for example, the "U," the solid bar, the "channel," the angle, the "T" and so on. Each of these types taken in cross section has a distinctive value within itself and within its relation to other parts of the brake beam structure. Each of them represents the means by which inventive genius competes for superiority in meeting conditions as they evolve. Tests of these types and features are continually going on.

There have been strong and eminent advocates of a standard beam. The railway men as a whole have prefered to leave the opportunity open for continued improvement. Since the proposal for a standard beam was made seriously in 1910 substantial improvement has been made.

A. H. Peycke writes: "The brake beam manufacturers have conferred with the Brake Shoe and Brake Beam Committee this last year with a view to straightening out a good many points in relation to interchange dimensions, clearance conditions, etc., and cites a report delivered before the M.C.B. convention in Atlantic City in 1919 by B. B. Milner, of the New York Central, suggesting changes which are necessary; also giving a complete synopsis of the brake beam situation since about 1905. Mr. Peycke's opinion is that "The standardization of brake beams would be decidedly disadvantageous to the railroads and people of the country, and any attempt to adopt a standard beam would suppress initiative, invention, genius and progress."

Albert Waycott observes: "Seven or eight different types of brake beams, all interchangeable on equipment in service and all meeting the M.C.B. tests, will surely illustrate how both improvement and competition might easily have been greatly reduced had any one type been insisted upon."

The manifest need today, according to C. Haines Williams, "is a more strict enforcement of existing M.C.B. rules and more rigid application of test and manufacturing requirements. * * * No single design of beam has advantages sufficient to compensate for the penalty of having brake beams stand still for years. * * * The initiative and unhampered genius that produced the brake beam and brake transmission rigging that has always satisfactorily controlled our high speed trains cannot with safety be destroyed. * * * The success of past practice guarantees proper care of future problems if not interfered with by standardization, which would unquestionably develop indifference on the part of the interested brake beam manufacturers of today. All the present M.C.B. rules, specifications, requirements and safeguards have come, without exception, from the recommendations and practices of brake beam manufacturers."

Whatever may be the future of voluntary standardization, it is our conviction that the best interest of the public lies in leaving the railways free without any government participation in the process.

Centralized Buying

An important consideration cognate to this view in every line of railway requirements is that of centralized buying. Standardization would, we fear, do more than put a stop to the maintenance of vigorous departments of the manufacturing establishments for the testing and development of new devices and features. Not only would all the companies be reduced, so to speak, to automata filling orders to specifications, but there would be the further tendency to concentration of purchasing in some central bureau. Its responsible heads would probably not get and keep personal knowledge of the reliability and resources of individual makers. Bidding would tend to be controlled more and more by the element of price, and less and less by the element of quality and durability. The bureau would tend to leave in the hands of subordinates the designation of those makers permitted to bid. Inevitably this would degenerate into a stereotyped process bereft of commercial enterprise and intelligence on both sides of the counter.

What demands the future will make who can phophecy? Charles J. Graham remarks: "Had the thought of standardization of parts been put into effect some years ago, we would still be using wooden brake beams. * * * The same is true today. There remains ample field for further improvements if they are not stifled by the fixing of standard details for parts."

We are told that locomotives and cars have reached nearly if not quite their maximum capacity; that they already crowd the overhead clearance of bridges and tunnels; that to widen the traffic gage would involve expenditures of appalling magnitude not only in acquirements of wider rights of way but in shifting and relaying existing tracks while traffic was carried on; that to lengthen the vehicles would involve us in costly track problems and complications involving station platforms and the like.

Such pessimism is a counsel of sloth. For freight transportation at least higher actual speeds may be a possibility contained in the now rapid elimination of grade crossings. To what extent will this and other tendencies toward fuller use of cars affect the stresses placed upon every part of the rolling stock? Is it certain that electric propulsion will bring no new conditions in this respect, or that fuel or other source of motive energy in the future is even yet identified? Who can affirm that the controlling factor in transportation development is yet dreamed of in our physics and chemistry or other branch of scientific pioneering?

The manufacturer has always anticipated each new demand. When it came he was ready for it. He can exist and perform that function only if experimentation is free on the several railway systems and if achievements for the welfare of mankind promise reward to the inventor of appliances and profit to the developer.

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The Anhalter Bahnhof in Berlin as Seen from the Passenger Dirigible, Bodensee

Operating Locomotive Boilers Using Treated Water

Instruction of Enginemen in the Use of the Blow-Off Cock Essential to Secure Best Results

By F. W. Dunning

TREATING WATER for locomotive boilers has received much attention for years. Today it is attracting still more consideration and those informed on the subject agree as to the benefits derived. It would not be feasible here to go into the merits of every method now used; suffice it to say that the majority of the roads have decided on the use of soda ash, or soda ash and lime together, as the most economical means for treating the average boiler water. The following discussion, therefore, deals chiefly with water treated in this manner.

The process of water treatment must be divided into two equally important phases; first, the actual mechanical features involved in introducing the chemical into the water; second, the handling of the water in the locomotive boiler, after treatment has been received. Both of these divisions need careful attention and close supervision. One of the greatest errors that can be made in water treatment is neglect of the latter feature. Very often the handling of the water in the locomotive boiler is entirely ignored, and due to this oversight the treatment is doomed to failure. Improper handling of the treated water can cause as much damage as the raw or untreated water.

The substances contained in the water in solution cause such trouble as scaling, pitting and foaming. It is utterly impossible to overcome these troubles by simply placing certain chemicals in the water, unless attention is given to other details. Some of these substances can be removed and the chemical form of others can be changed, but not all the troublesome matter can be removed. Therefore it is necessary to call on the engineman to help out, particularly where soda ash is used.

Interesting Enginemen in Water Treatment

The engineman cannot assist in securing the best results from the treatment unless he has the necessary information, and while this is not simple, yet it is fairly easy to assimilate. Whether the instructions are given by bulletin or by talks collectively or individually does not matter parcticularly, although it is necessary to use all these methods to a greater or lesser extent. The point is, the engineman must know how to handle the boiler when using treated water. Few men will continue to carry out mere instructions unless they have reason to believe they are accomplishing some useful result. Therefore the objects and purposes of the water treatment should be fully explained.

One good method for educating the enginemen is as follows: Some capable person should be placed in charge of the educational work, local conditions determining how much time must be allotted to this subject. First, a list of all enginemen and firemen in the territory under consideration should be procured, and preferably by personal observation these men should be graded as to their knowledge, ability and performance in handling the locomotive boiler. The men at the bottom of the list can be given special attention and instruction. It is then a simple matter quickly to remedy boiler troubles insofar as man failures are concerned.

Causes of Foaming and Priming

All the trouble resultant from water treatment is caused by the foaming or priming of the water. Generally, foaming can be attributed to the following substances contained in the water: animal or vegetable matter, mud or sediment, and alkali salts. It is not necessary to consider the first cause as this is not a result of treatment, and should be avoided by changing the source of supply, or removing the substances before passing the water to the engine tank. Alkali salts and sediment such as sludge are a result of soda ash treatment, although these substances frequently occur from natural causes. Soda ash, when introduced into the water, attacks the sulphate of lime, changing it into carbonate of lime and sulphate of soda. Only a small portion of the carbonate of lime is precipitated before the water reaches the boiler; the remainder causes the white sludge present in the boiler. The sulphate of soda is an alkaline salt and remains in solution. As water is continually being evaporated the sulphate of soda continues to increase in quantity since it does not pass off with the steam.

When the boiler is allowed to remain quiet, the mud or sludge has a tendency to settle and work back toward the firebox. Thus it will be found that the suspended matter is much more heavily concentrated at the blow-off valve than it is at the water glass. The distribution of the alkaline salts, which are in solution, is practically uniform throughout the boiler. To reduce the mud, it must be allowed to settle and then be removed by opening the blow-off valve. To reduce the alkaline salts, part of the water must be blown out and replaced with water containing less alkaline salts. This does not require separate blowing for each case.

Reducing Concentration in Boilers

For instance, assume the alkaline salts have reached a concentration of 200 parts per hundred thousand. The concentration is not reduced by simply removing part of the water. The alkaline salts are uniformly distributed and the water remaining in the boiler has the same amount in solution as the water blown out. It is necessary to open the injector and replace the water blown out. If the tank water has only 20 parts of alkaline salts and 10 per cent of the contents of the boiler is added as fresh water from the tank, the result is the boiler water will now show 182 parts of alkaline salts per 100,000 parts of water. It is apparent then that the reduction of the alkaline salts can only be accomplished by blowing out and replacing with water of a lower concentration.

As water is continuously being evaporated, and the amount of mud and alkaline salts continuously increased in the boiler, it is necessaray to remove these substances before they get to a troublesome point. This means the boiler must be blown out at equal time intervals during a run. These intervals and the amount to remove must be determined by the quality of the water. Heavy treatment will entail heavy blowing and light treatment a lesser amount of blowing.

Use of the Blow-Off Cock

The proper time for blowing out is four or five minutes after both the throttle and injector have been shut off. This allows violent circulation to stop and the sludge to settle where the blow-off valve can remove it. It is well not to remove more than six inches of water as measured in the water glass at one time, because an undue amount of cold

water has a bad effect on the flues and firebox sheets and may cause leaking. The blow-off should never be opened while the injector is working (except in emergency) as this brings the cooling effect on the firebox sheets to the extreme limit, and also allows a great deal of fresh water to pass out.

Definite directions for blowing out cannot be given without investigating thoroughly the quality of the water in use in the territory in question, or running several tests to determine the proper amount of blowing that is necessary. Foaming trouble can be materially lessened by carrying the water low in the boiler. Arrangements should always be made at terminals to have the hostler give the boiler a certain amount of blowing out, thus lessening the amount of blowing which must be done on the road.

The whole question of taking care of the boiler using treated water resolves itself into a matter of the proper way and proper time to do the blowing out. The proper way is explained above. The proper time must be determined by conditions and should be extended to three or four periods, occurring at about equal intervals during a run. All the blowing out should never be attempted at one time, neither at the beginning, middle, or end of the trip, as satisfactory results will not be obtained in this manner. When the proper amount and time for blowing off have been determined, this schedule should be strictly adhered to.

The La Crosse division of the Chicago, Burlington & Quincy has averaged about 2,000 miles per boiler per washout. This means about one washout per month for each boiler. This division uses soda ash treatment at all of its water stations. Other divisions will approximate this performance when the blowing out proposition is given sufficient attention.

Analyzing Samples from Boilers

At the various terminals or sub-division points on those divisions of the Chicago, Burlington & Quincy system where treatement is used, samples of water are collected at least once a month from locomotive boilers. These samples are analyzed and reports sent to the master mechanics in charge of the territorty affected. Explanations accompanying each report state whether the treatment is correct or not, and also call attention to the amount of blowing out, as determined by the total dissolved solids or alkaline salts in the water. It then devolves largely on the master mechanic to take such corrective measures as are necessary to insure the proper blowing out. The treatment itself is maintained correct by frequent inspections and analyses at the various treating plants, and these boiler samples serve also as an additional check on the various waters last used by the locomotive.

Thousands of dollars have been saved in locomotive repairs, flue failures, washing out, and in coal consumed, through the medium of treated water. Thousands of dollars have been wasted on water treatment because enginemen were not informed about their part of this work, and the project in many instances has been given up.

Results Secured by Co-operation

Many cases have come to my attention where one engineman on a certain division would have no trouble with treated water, while the next man would continually have difficulty. The first man had made it a point to inform himself on the subject, while the other had made no effort to get the all-important information. One particularly striking case occurred with two passenger enginemen on the same run. The first man had a "regular" engine on a hard local run. Conditions were excellent on this run for foaming trouble, as every water station on the division furnished water treated with soda ash. However, this engineman had no trouble and repeatedly offered to run his engine 30 or even 60 days to a washout. As a matter of fact, the boiler was washed out every 15 days. One day the regular engineer "layed off" sick, and his run was taken by a second man, who was also a regular passenger engineman. There was no end of foaming trouble while he was on the run. The boiler must be washed out after each trip. This man was of the type who did not take kindly to the information at his disposal. His attitude was, "I have run engines thirty years ago, before we ever heard of water treatment, and I can see no advantage at this late date in using soda ash. It is all rot." When the other engineer came back on the job there was no further trouble. The engineman who would not assist in getting the best results from treated water did not bother to learn that the life of this same locomotive boiler had been increased over 100 per cent between shoppings for boiler repairs since the water treatment was introduced.

The same point is illustrated in connection with the introduction of water treatment on two railroad divisions; the first division had its entire force of enginemen lined up in about four months from the time it was introduced, and the locomotive performance was remarkable as compared to the previous period. In this case the two traveling engineers made a special point of instructing these men on handling the boiler. The second division, after ten months, was still having trouble. In the latter case the traveling engineers made no special attempt to educate the men on the proper handling of the locomotive boilers. The results in each case illustrate my point.

It cannot be emphasized too strongly that where water treatment is contemplated, the handling of the locomotive boiler must be given full and proper attention. By neglecting this phase of the subject, water treatment can be made an entire failure where otherwise it would effect a big saving.

Why the Railroads Should Be Returned

A. H. Smith, formerly regional director under the Railroad administration, who recently resigned to return to the presidency of the New York Central, has outlined his views regarding the railways in a letter to Senator Calder of New York, in which he says:

When I resigned as regional director of the United States Railroad Administration certain newspapers asked for a statement of my impressions of government operation of the railroads and my views of the railroad problem generally. I have refrained from issuing such a statement, believing that it would be best to convey any ideas that I have on the subject to you and the other gentlemen who are working on the problem. Therefore, if your mind is still open with reference to the solution of the railroad situation, perhaps what I have to say may be acceptable to you.

The human element in American railroads represents 90 per cent of its effectiveness. The other small percentage of the whole would be useless without individual vision, effort and experience. Fixed responsibility really has seemed to be impossible under government management. It leads into such a maze of interests and interferences that the employees do not get into that state of mind that they do in private operation, and the state of mind is one of the most important parts of railroad operation. Destroy it and the effect is manifest all through the rank and file and every part of the great machine.

I know that you realize fully that it is a business that must have the individual concern of the employee—the engineer at the throttle, the fireman beside him, the conductor, the flagman, the signalman, the section foreman, and on up to the officers of the company—they all must have a

fixed responsibility. Most of the work is done beyond the eye of the officers, because it spreads over a vast territory. The man at midnight and in the storm must do his duty absolutely and fully, with no one to see him and no one to direct him. He must have an incentive—not one of mere salary, but one of pride and hope that he may some time be more than he is.

It has been stated, and so far as I know never disputed, that before the war the American railroads for each dollar paid them rendered considerably greater and substantially better service than the railways of England, France or Germany. The European railways, however, do not in any degree compare with the American railways in extent. They are short railways for the most part, with dense populations, while the American railways are spread over a vast and, in some cases, sparsely settled territory.

If we are to become what we are destined to become if we make no mistakes—a great commercial country, from a foreign as well as a domestic standpoint—we must have sufficient and efficient transportation. Those that produce it by providing the capital and labor should be properly rewarded. The manufacturers and the merchants and the public as a whole owe that to them. Ours is a country of great distances, and with that handicap we shall not be able to compete successfully with those countries with shorter distances unless our transportation system is adequate and efficient. The American railways require capital properly and liberally expended to furnish more facilities and modern equipment to offset the labor and other charges which have been placed upon them. To my mind, it is important, therefore, that a fair return be allowed, so that capital will enter and provide those facilities.

Looking backward, it is a little over a year ago when the congestion was so acute that the people were willing to pay almost anything for transportation if they could have it, and such conditions should be avoided. These railroads have stood still in their expansion and development, broadly speaking, for a long time. Economy is going to come in their expansion and refinement, and economy in rates will result, not from radically cutting wage costs, but by giving the railroads and employees a better machine to work with, more facilities, more yards and shops, and other essentials that go to make up a successful transportation instrumentality. Pre-war we had approximately $450,000,000 of equipment standing idle. Since the signing of the armistice we have seen substantially the same condition repeated. This is a situation that is inevitable and the compensation to the railroad companies must provide for the lean years which produce such a condition, for the reason that it is impossible to provide the facilities as fast as the business demands in periods of abnormal traffic.

In the matter of the return of the railroads to the corporations: My opinion is that they should be restored at an early date. It will eliminate uncertainty in the state of mind referred to previously, and the morale will improve. The government said when the roads were taken over that they would be returned in as good condition as when they were taken. That means not only physically but as nearly as possible mentally, and the government can not afford to do other than to keep its promise. Perhaps a law can be written that will cover all the involved questions that exist and permit settlement with the restoration. But the situation is very complicated, and it may be that the government will find it advisable to appoint a commission or board to make the settlement after the return, in the meantime giving the benefit of private operation to the people—the present system of compensation being continued as a guaranty pending settlement—a limited time to be allowed after the return to effect the settlement and avoid protracted delays. This commission might well be made a permanent feature of our system of railroad regulation and should be composed of at least three commissioners and be charged with the responsibility of keeping informed with respect to the transportation necessities of the country generally, and to make representations to the Interstate Commerce Commission with respect to the revenues required to provide the necessary facilities and service and insure proper development of the transportation system.

The cases of the weak and the strong roads, so to speak, should be weighed out by this commission. If the road is so weak that it can not stand, it should have special treatment. If it is absolutely necessary to the needs and comfort of the people it should have some extra allowances locally or otherwise. The entire rate structure should not be thrown out of proper position because of some exceptional case any more than any other business undertaking in our country should be gaged by the exceptions. The question of rates, in which the public are most deeply concerned, because it affects the cost of living and the amount of business we may do, is a matter for study by experts. Much has already been accomplished in this direction by the Interstate Commerce Commission and those drafted into government service, and they have shaped up a great amount of valuable information which is available to any authority that the government might designate. Rates established as a war measure and to meet the changed conditions should be continued as presumptively reasonable. Pre-war rates should not be the basis of future rate regulation. I believe that it is generally admitted that the interstate commerce law sought to regulate the railways on a basis of reasonableness and justice. The operation of that act, however, has put the burden of proof in all instances on the railroads, and that, it seems to me, is a fundamental violation of justice. As I see it, what is needed is to bring order out of the confusion of conflict of regulation between the various authorities.

Briefly, the foregoing suggestions contemplate the prompt return of the railroads; the continuance of the present rates until changed and adjusted to meet the largely increased charges; the continuance of the guaranteed standard return until this is accomplished; the creation of a board or commission which will act as an administrative board, charged with the responsibility to represent the public interest in respect to the adequacy of facilities and service, and in addition to exercise the functions and powers of the present Interstate Commerce Commission, except as to accounting, valuation, rates, etc.

It is estimated that 12 per cent of the Nation's wealth is invested in the country's transportation systems. It is safe to say that 100 per cent of the public interest is involved therein. It is one of the great problems that we have before us. It is of prime importance that it be solved properly. Politics or theories have no place in its consideration; it is a business of manufacturing transportation. Good machinery should be used, together with good brains and full effort, to the end that the country and the people shall continue to have what they always have had—the best transportation in the world; the greatest in volume and heretofore the least in cost.

On Guard Against the Wicked Railroads.—The New York Board of Trade and Transportation has written to Chairman Esch of the House Committee on Interstate and Foreign Commerce, requesting the passage of a joint resolution (a draft of which is offered) "to continue in effect rate making laws until Congress shall enact the general railway laws" for which the country is waiting. The letter declares that in the probable absence of the passage of any such general railway legislation this month the effect of President Wilson's recent veto of the Senate bill to restore the Interstate Commerce Commission's pre-war powers will be to give the railroads full power to raise rates without hindrance.

All Steel Spreader Plow Embodies New Feature

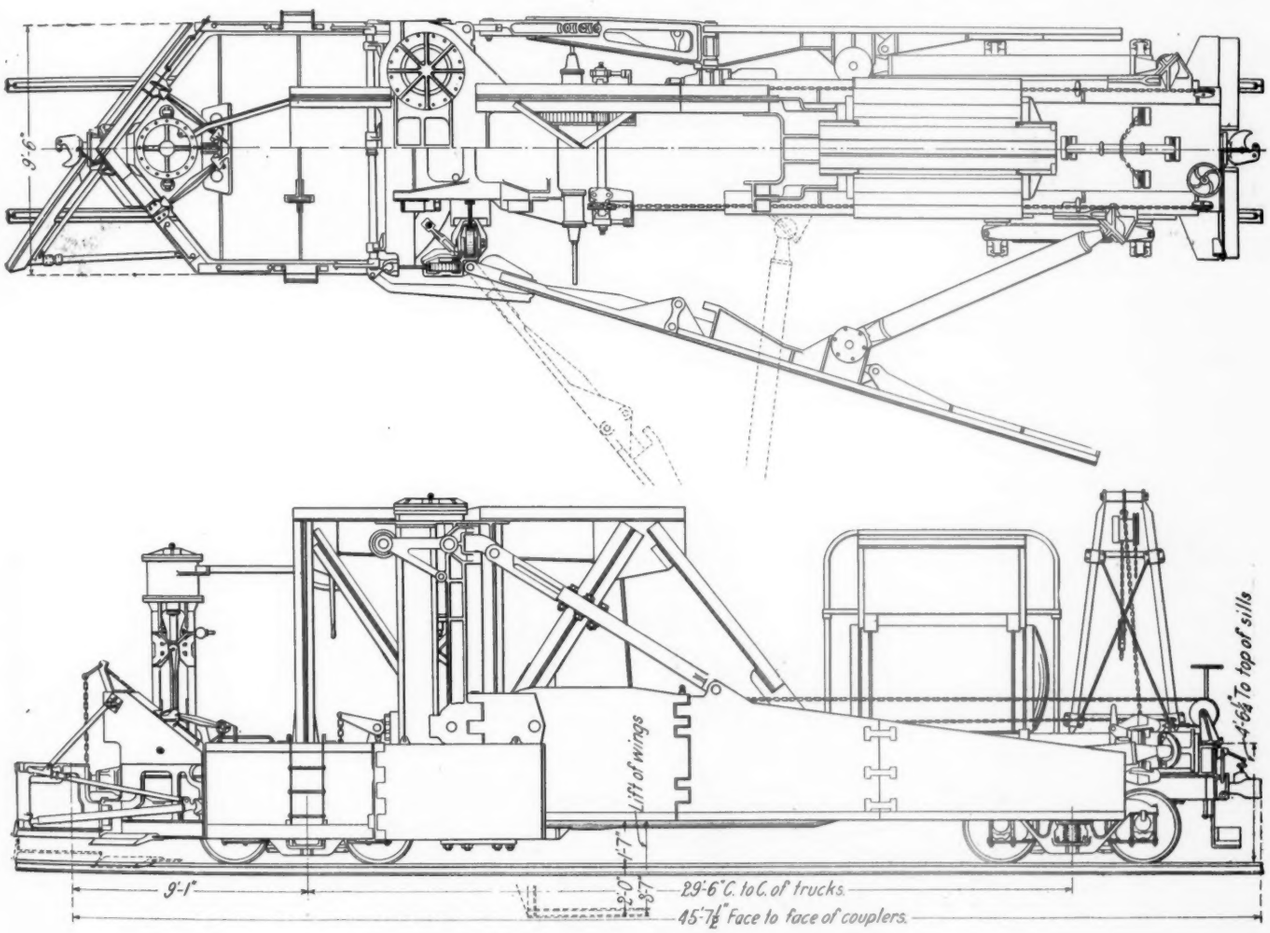
Unusually Heavy Machine Was Recently Subjected to Series of Severe Service Tests

THE BUCYRUS COMPANY, South Milwaukee, Wis., has developed and is now introducing a spreader plow which embodies a number of new features, and also involves much heavier construction than any previous designs. This spreader has recently been subjected to an extended series of tests under heavy service on the lean ore and waste dumps of the Oliver Iron Mining Company, at Hibbing, Minn., where it has demonstrated it's ability to stand up under unusually severe conditions. It is designed to plow material from between the rails to either or both sides to a depth of 2½ in. below the top of the rail and to spread it at either side to a maximum distance of 22½ ft. from the center of the track.

This spreader plow is of unusually heavy design and is built of steel throughout. It weighs 136,620 lb. of which 80,640 lb. is carried on the front truck, this latter weight being an important factor in holding the spreader on the track and reducing the liability of derailment. The frame is designed throughout for 100,000 lb. draw bar load. It is equipped with the Waugh friction draft gear, which with the trucks is built to M. C. B. Standards.

The wings, which weigh approximately 12,000 lb. each, are solid steel castings made in three sections with a total length of 25 ft. The section at the outer end is hinged to the rest of the wing and held in position by three Bishop bolts or shrink links so designed that they will break and allow this section of the wing to swing back on striking a stationary object, before the wing itself suffers injury. When in position the wing spreads a minimum width of 12 ft. and a maximum of 22½ ft. when horizontal or when inclined at the greatest angle. It can spread to a level of 19 in. above the top of rail or 24 in. below, giving a maximum vertical range of 43 in., which can be secured in increments of three inches. The wing can also be inclined at the outer end to a maximum depression of 12 in. below or to an elevation of 84 in. above the inner end. The wearing edge of the wings is of high carbon steel angle castings. An important and distinctive development in this spreader plow is the arrangement whereby the wings can be folded in to the car regardless of the pitch or angle at which they may be standing.

The spreader wing is held in plowing position by a tubular brace built of 9-in. extra-heavy, lap-welded steel pipe. The forward end of this brace is connected to the wing by means of a universal joint, while the rear end is connected to a movable cross-head by means of a ball and socket joint.



General Plan and Elevation of New Spreader

The travel of this cross-head determines the width of spread. This width of spread may be varied by increments of approximately 1 ft. between 12 and 16 ft. and by increments of 6 in. from 16 ft. to 22½ ft. This arrangement is also a unique feature and makes it possible to open and close the wing from the cab automatically to any pre-determined width of spread. This may be accomplished with little effort and with no loss of time. The vertical inclination of the wing above and below the horizontal is accomplished by shortening or lengthening the inclined support brace.

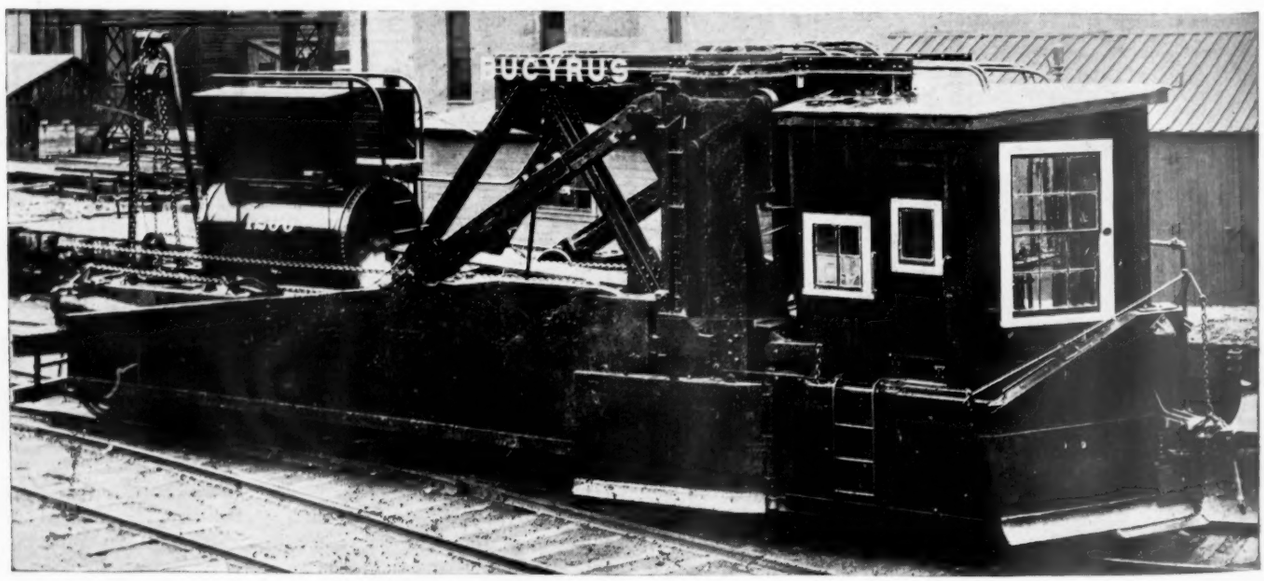
The V-shaped pilot plow is located in front of the main car body and is arranged in such a manner that it may be used for plowing and flanging either snow or ice from between the rails to a depth of 2½ in. below the top of the rail. Each side of the pilot plow carries a transfer or shift wing that can readily be opened and fixed in position by one man, for the purpose of transferring loose material from one side of the track to the other.

Rear View of the Wing, Showing Construction

Four air cylinders control all the operations of the plow. The air for the operating cylinders is taken from the locomotive and the machine is provided with an air reservoir four feet in diameter by seven feet long.

All movable parts of the spreader are machine finished which tends not only toward accuracy of fit but towards ease of operation with resulting conservation of air. The contact between the wings and the vertical sliding posts on which they are raised and lowered is by rollers, greatly reducing the friction from that with a sliding contact. As a result the wings can be raised with a minimum air pressure of 50 lb. while the spreader plow can be operated readily with the average train line pressure of 70 lb. Summing up, the plow presents to railroad men: A wide range of spread both in width and elevation; The automatic opening and closing of the wings to any pre-determined width; The opening and closing with the wings to any vertical angle; Adaptability to flanging snow and ice from between the rails and use as a snow plow in yards or on the main line.

Plowing a Shoulder Down



The Spreader With Wings Folded Back

One cylinder is employed for raising and lowering each of the two large wings, one for raising and lowering the pilot plow and one for opening and closing both wings. These cylinders are controlled by four-way valves located on a table in the front of the car which may be enclosed in a cab.

Interchange Inspectors' and Car Foremen's Meeting

Discussion of Changes in the Rules of Interchange; Uniform Inspection Records Advocated

THE CHIEF INTERCHANGE CAR INSPECTORS' and Car Foremen's Association met at the Planters Hotel, St. Louis, Mo., September 23-25, with W. J. Stoll, chief interchange inspector at Toledo, Ohio, presiding. At the first session, prayer was offered by Captain Arthur Andrews of the Salvation Army; L. McDaniel, prosecuting attorney, welcomed the convention, T. J. O'Donnell responding for the association.

President's Address

In his address as president of the association, Mr. Stoll spoke in part as follows: "The discussion of the M. C. B. rules and other matters pertaining to the construction and maintenance of cars is an important question and one which requires sound judgment and executive ability. The changes in the M. C. B. rules of interchange, which take effect October 1, while not numerous, are quite important. The rules now in effect have not as yet been discussed by this association, and I hope the members will take advantage of this opportunity to discuss them. I would also call attention to the fact that the loading rules have been rearranged and a discussion of them would be of interest and beneficial, as many cars are being improperly loaded. This association might well recommend that shippers should be furnished with copies of the loading rules. Because of the conditions which have been brought about by the war, such as pooling certain portions of the equipment, routing cars away from home where material was not available to make proper repairs, insufficient help, etc., it is necessary for this association as well as others to put forth its best efforts to remedy conditions."

The report of the secretary-treasurer was then read; it showed that the total membership was 508 and that there was a satisfactory balance in the treasury.

Discussion of the Rules of Interchange

At the session on Tuesday afternoon, the discussion of the Rules of Interchange was taken up. The first question raised was with regard to the meaning of paragraph 6 in Rule 2, which reads, "Empty cars offered in interchange, if in safe and serviceable condition, must be accepted." T. J. O'Donnell (Buffalo) asked what constituted a serviceable empty car and whether this rule was to be construed as permitting the offering in interchange of cars with minor defects, which could readily be repaired. F. C. Schultz (Chicago) advocated ignoring slight defects in order to expedite traffic. There was considerable difference of opinion as to whether the receiving line had the power to refuse cars which were not serviceable for the commodities for which they were desired. F. Trapnell (Kansas City) stated that instructions had been received from the regional director defining what should be regarded as a serviceable car and in the Kansas City Terminal district inspectors had been working under this interpretation. Several expressed the opinion that under present conditions it is necessary for the joint interchange inspectors to allocate cars to the various railroads, taking whatever measures local conditions make necessary to move the traffic. Mr. O'Donnell contended that there should be some general ruling which could be applied regardless of the immediate circumstances. G. Lynch (Cleveland) brought out that the rules make a definite distinction between the handling of loaded and empty cars. While loaded cars must be accepted by the receiving line and run, repaired or transferred, the empty cars can be rejected if in the judgment of the receiving line they are not in safe and serviceable condition. This rule has made it easy for roads that originate a great deal of traffic to get cars off their lines, while roads that offer a great many empty cars to connections have suffered from the accumulation of bad order cars which they are unable to dispose of.

The discussion showed that there was a wide diversity of practice in different sections of the country, due in part to lack of uniformity in the orders issued by the regional directors. A committee was appointed to consider the matter further and to present a report to the convention. The committee after deliberation reported that it did not feel it consistent with the basic intent and purpose of this rule and the decisions thereon by the Railroad Administration, that any changes in the application of the rule should be recommended other than the proper supervision by those in authority at the several terminals and interchange points consistent with local conditions.

Changes Recommended by the Arbitration Committee

Following the discussion of Rule 2, the association proceeded to consider changes in the rules as recommended in the report of the Arbitration Committee presented at the 1919 convention of the Mechanical Section of the American Railroad Association. The revised text of the rules, together with the discussion concerning them, are given below:

Rule 32. (Delivering line responsible) Damage to any car (including cars on ferries or floats) if caused by (a) derailment, (b) cornering, (c) side swiping, (d) collision or impact other than that occurring in regular switching, (e) handling of cars with broken or missing couplers, or couplers out of place, (f) colliding with or shoving over bumping post or other fixed obstruction, (g) shifting of loads from other cars, (h) overloading, (i) explosion, (j) collapsing buildings or other structures on right of way, (k) unconcealed fire damage, (l) flood, (m) storm where car is derailed or destroyed, (n) failure to close hopper or drop doors before moving car.

The former wording of this rule made the delivering company responsible for damage due to wrecks, and this indefinite term had caused many controversies. H. W. L. Porth (Swift & Company) brought out that while the changes clarify the meaning of this rule, the judgment of the inspector will still enter in determining what constitutes regular switching. F. C. Schultz stated that the rules now in force made it possible for roads to break up cars in switching and yet hold the owners responsible for the damage if the trucks were not derailed. G. Lynch called attention to the fact that the terms collision, impact and regular switching are still indefinite and even the new rule will be hard to interpret. J. P. Carney (Michigan Central) expressed the opinion that the changes in the rule were not intended to put the responsibility for damage to weak equipment on the handling line. A motion was adopted stating that it was the sense of the meeting that if cars are damaged the owner is to be held responsible, if the trucks are not derailed and the car is not cornered or side swiped.

Rule 66. (Owners responsible) Periodical repacking of journal boxes, regardless of the responsibility of delivering company for change of wheels, journal boxes or journal bearings. No charge shall be made for repacking unless all boxes are repacked. No charge shall be made if the repacking is done within nine months from date stenciled on the car. If car bears no stenciling showing date of previous repacking, all journals may be repacked if necessary and charged for.

(a) All journal boxes shall be repacked with properly prepared packing (new or renovated) at least once every 12 months, at which time all packing will be removed from the boxes and the boxes cleaned. Dust guards to be renewed when wheels are changed.

The requirements for periodical repacking of journal boxes were endorsed by all who discussed the rule. The opinion was expressed that this practice would improve op-

erating conditions and result in a large saving. Attention was called to the fact that the work is often slighted and it was suggested that improper repacking could be eliminated by requiring the work to be done only at stations which are equipped with apparatus for reclaiming oil and waste.

Inspection of Loads in Open-Top Cars

A question was raised as to the advisability of inspectors making records of depressions in loads shipped in open-top cars in order to eliminate leakage en route and to protect the railroads in case claims for shortage are filed by the shipper. The discussion brought out that at most terminals the inspectors who examine the roofs of the cars are required to note any apparent shortages. A report is made to the agent and the cars are weighed to determine the loss of contents and to establish the amount occurring on each line in case the shipment is hauled over more than one road. In general, if the road does not transfer the load it must participate in any expense due to loss of lading.

Interchange Inspection Record

President Stoll stated that a communication had been received from one of the large interchange points asking that uniformity of inspection records at interchange points be discussed at the meeting. T. J. O'Donnell stated that in the Niagara district some roads require the inspectors to take the numbers of all cars interchanged, while others record only the defective cars. J. C. Keene (Wabash) brought out the fact that there is no standard form for keeping the record of cars interchanged. Mr. Keene advocated the adoption of a uniform form which would be a check against the interchange record. F. W. Trapnell (Kansas City) assented that the car inspector's record is valuable, as no record of seal numbers is taken and there is less liability of error. H. J. Smith (D. L. & W.) objected to any practice which would compel the car inspectors to write the number of every car interchanged, on the grounds that it would consume much time that should be devoted to other work. This contention was sustained by several other members. One member brought out the fact that claim agents often request records of the condition of cars when interchanged from the car inspectors and no information can be furnished on cars not found defective unless the numbers and initials of each car are taken down. J. C. Keene brought out that the interchange record does not necessarily furnish proof that the car has been inspected at the time it was interchanged. T. S. Cheadle (Richmond) stated that since the inspectors had been relieved of the necessity of recording the numbers of all cars, more efficient inspection had been secured. A committee was appointed to consider the matter and report upon it at the next convention.

Other Business

On Wednesday a special train was provided for the members so that they might make an inspection trip around the St. Louis Terminal district. At the closing session addresses were delivered by A. E. Bouchner, superintendent of the Terminal division of the Missouri, Kansas & Texas and also chairman of the Interchange Committee of St. Louis, and by L. T. Canfield, of the Union Draft Gear Company.

The following officers were elected: president, J. J. Gainey, general foreman car department, Southern; first vice-president, E. Pendleton, car foreman, Chicago & Alton; second vice-president, A. Armstrong, chief interchange inspector, Atlanta, Ga.; secretary-treasurer, J. C. Keene, general car inspector, Wabash.

List of Exhibitors

The following is a list of the companies exhibiting at the convention:

American Brake Company, St. Louis, Mo.—Foundation brake gear for cars and locomotives. Represented by R. E. Adreon.

American Brake Shoe & Foundry Company, New York.—Brake shoes for freight and passenger cars and locomotives. Represented by C. G. Weaver.

American Steel Foundries, Chicago.—Simplex adjustable coupler pocket with detachable shelf, Economy draft arm, Simplex coupler, Atlas safety guard. Represented by W. C. Walsh, J. H. Tinker, M. De Anglis and W. G. Wallace.

Bettendorf Company, Bettendorf, Iowa.—Freight cars, Bettendorf car trucks, steel castings. Represented by J. W. Clasen.

Boss Nut Company, Chicago.—Boss lock nuts, bolts, rivets and screws. Represented by W. G. Willcoxson, J. W. Fogg and W. C. Irwin.

Buckeye Steel Castings Company, Columbus, Ohio.—Cast steel coupler yokes, Major couplers, M. C. B. type D couplers, Andrews channel section side frames, U. S. R. A. standard tender bolsters, Buckeye truck bolsters, cast steel box section body bolsters. Represented by F. J. Cooledge.

Chicago-Cleveland Car Roofing Company, Chicago.—Pressed steel ends, outside metal roofs, all steel roofs and pressed steel parts. Represented by R. C. Munro and J. L. Stark.

Chicago Pneumatic Tool Company, Chicago.—Little Giant air drills, Boyer pneumatic hammers. Represented by L. C. Sprague, C. W. Cross and H. W. Buker.

Chicago Railway Equipment Company, Chicago.—Cresco brake beams, Creco third point support. Represented by E. A. LeBeau.

Columbia Nut & Bolt Company, Bridgeport, Conn.—Lock nuts. Represented by H. P. Cook and J. E. Eipper.

Commonwealth Steel Co., St. Louis, Mo.—Underframes and ends for passenger cars, transom draft gear, steel castings. Represented by G. E. Howard and C. S. Shallenberger.

Duff Manufacturing Company, Pittsburgh, Pa.—Barrett car repair jack, Duff ball bearing journal jacks and car and locomotive jacks. Represented by C. N. Thulin.

Galena Signal Oil Company, Franklin, Pa.—Lubricating oils. Represented by W. E. Auger, W. J. Burnett, T. J. Powell and R. E. Webb.

Gold Car Heating Company, New York.—Gold vapor system of car heating, steam pressure regulators, steam hose couplings, thermostatic control end valve. Represented by W. H. Ivers and A. Sheldon.

Griffin Wheel Company, Chicago.—Chilled iron car wheels. Represented by H. N. Scott

Grip Nut Company, Chicago.—Grip nuts. Represented by H. J. Tierney.

Heath & Milligan, Chicago.—Railway paints. Represented by W. H. Pratt.

Hutchins Car Roofing Company, Detroit, Mich.—Hutchins flexible all steel roof, Hutchins standard all steel roof, Hutchins Type D outside light gage metal roof, Hutchins plastic roof. Represented by A. R. Wilson and C. F. Pape.

Imperial Appliance Company, Chicago.—Uncoupling attachments. Represented by J. T. Cralley.

Independent Pneumatic Tool Company, Chicago.—Thor air drills, hammers, pneumatic hoists, air hose couplings, Universal electric drills. Represented by R. S. Cooper and F. J. Passino.

Joliet Railway Supply Company, Chicago.—Bolsters, brake beams, side-bearings, journal boxes. Represented by J. E. Simons.

Lehon Company, Chicago.—Mule hide canvas roofing for cabs, Mule hide insulating paper and fabric, plastic car roofing. Represented by D. B. Wright and C. V. Eades.

McCord & Company, Chicago.—Journal boxes for freight and passenger cars. Represented by J. A. Lamon.

Mahr Manufacturing Company, Minneapolis, Minn.—Oil burning torches and rivet forges. Represented by N. S. Griffith and D. W. Simonds.

W. H. Miner, Chicago.—Friction draft gear, side-bearings, Ideal safety hand brake, bolster locking center pin and drawbar yokes. Represented by A. L. Canavan and J. R. Mitchell.

National Malleable Castings Company, Chicago.—National quadruple shear cast steel yoke for passenger couplers, M. C. B. Type D coupler, Sharon coupler, National extended floor engine pockets. Represented by C. H. McCrea and G. V. Martin.

Oxweld Railroad Service Company, Chicago.—Cutting and welding torches and tips, oxygen and acetylene regulators. Represented by Wm. Leighton, J. P. Furbeck and A. L. West.

Pierce Oil Corporation, St. Louis, Mo.—Lubricating oils. Represented by J. J. Casey, E. S. Marshall, F. Reardon and R. M. Wiggin.

Scarritt Car Seat & Manufacturing Company, St. Louis, Mo.—Seats for railroad coaches. Represented by B. C. Howard.

Simmons-Boardman Publishing Company, Chicago.—Railway Age, Railway Mechanical Engineer, Car Builders' Dictionary, Locomotive Dictionary. Represented by C. L. Smythe, J. W. Bailey and J. W. George.

Southern Wheel Company, St. Louis, Mo.—Chilled iron car wheels. Represented by W. C. Doering.

Union Draft Gear Company, Chicago.—Cardwell friction draft gear. Represented by J. W. Hathaway and C. J. Gorman.

Union Spring & Manufacturing Company, Louisville, Ky.—Car springs. Represented by A. C. Woods and J. W. Chandler.

Universal Draft Gear Company, Chicago.—Cast steel draft arms, draw bar yokes, draft lugs and tandem draft castings. Represented by C. C. Kinsman.

Western Railway Equipment Company, St. Louis, Mo.—Car door fixtures, malleable journal bearing wedge, Western steel carline, Western timber pockets, Acme pipe clamp, security dust guard, Western brake jaws. Represented by S. H. Campbell and R. M. Hoerr.

Westinghouse Air Brake Company, Wilmerding, Pa.—Air brakes for freight and passenger cars. Represented by F. B. Johnson.

Wine Railway Appliance Company, Toledo, Ohio.—Wine steel ladders, Wine side bearings, Wine hopper door latches, Wine ventilators. Represented by W. E. Wine, W. F. Cremain and C. J. Holland.

The San Francisco (Cal.) Chamber of Commerce has complained before the State Railroad Commission that the Southern Pacific charges excessive rates on lumber between San Francisco and all California points, but the complaint has been dismissed by the Commission. The Commission holds that it lacks jurisdiction because the lines in question are under federal control. For the same reason the Commission discontinued its investigation into the intrastate lumber rates of the Atchison, Topeka & Santa Fe, the Western Pacific, the San Pedro, Los Angeles & Salt Lake, the Southern Pacific and the Northwestern Pacific.

The Unification of Terminals and Foreign Commerce*

Formation of Local Commissions Proposed to Develop and Operate All Port Facilities

By T. C. Powell
Director of Capital Expenditures, U. S. Railroad Administration

IT IS A TRITE SAYING that history repeats itself, but, as a matter of fact, shipping has always been ahead of the port facilities. In 1860, the Great Eastern (sometimes called the Leviathan) made her first trip from England to the United States, and then found that there was no port in this country with sufficient depth of water to accommodate her draft. We pass over a period of a great many years and reach the year 1918, when we operated as a transport of the United States, one of the German ships which had been interned in New York, and which was also christened the Leviathan. On the first trip that this Leviathan made with American troops, she also encountered the difficulty of inadequate port facilities, and was compelled to land in Liverpool because there was not a port in France deep enough to accommodate her great draft.

Under the impetus of war, and under the direction of the War Department, of which S. M. Felton, director general of military railways, was the representative, the ports of France assigned to the American army were radically improved. The channels were deepened, new piers were constructed and unloading machinery was installed, so that in these ports of France there were cranes of a size such as had never been put in use in any port of the United States. If this can be done by the United States government in an emergency within a few months from the time the emergency appeared, it seems as though we should, in the next few years, provide equal, or greater, facilities in this country for all of the ports of the Union.

Lack of Information Regarding Ports

It was because of the lack of information regarding American ports and because of the need of assembling all available data for further consideration and use by the U. S. Shipping Board, that that board created the Port and Harbor Facilities Commission. The commission, through its department of statistics, has collected, and is collecting, all possible available data, not only with respect to the American ports as they now are, but also in regard to foreign ports in Great Britain and France.

The chief engineer of the commission, Captain Chambers, was sent to Great Britain, and has returned with a very large amount of data obtained through the courtesy of the officials of Great Britain. Director General Felton, who is also vice-chairman of the commission, made an exhaustive examination of the French ports. Captain Chambers developed that the English ports, to some extent, were very much in the same condition as the American ports with respect to the diversified authority in charge of the facilities. . . .

Scope of the Harbor Commission's Work

The Port and Harbor Facilities Commission is making studies not only of the physical conditions at each port, but of all conceivable factors affecting foreign traffic. In cooperation with the Department of Commerce and the Railroad Administration, the commission is securing statistics of the products of each state and each industrial community and is comparing and analyzing that proportion of traffic which is exported, as compared with the domestic traffic marketed in the United States.

Many tables and charts have already been prepared, and by extending the studies to an analysis of the imports from foreign countries, the commission will be able to show at any time the relative volume moving into and out of the United States, thereby posting the exporter as to the most economical ports and routes.

In addition to these investigations, the Port and Harbor Facilities Commission, under the resolution creating it, is also authorized to investigate the situation as to drydocks, coaling piers, ship repair plants, etc., and to recommend to the Shipping Board additional facilities of this character.

The commission has established close relations with the Department of Commerce. The speaker is one of the unofficial advisors of the secretary, and it is gratifying to know that the recommendations of Secretary Redfield have been approved by the Appropriations Committee, and the indications are they will be approved by Congress, with the result that for the development of foreign commerce alone, there will be a fund of over $900,000 available, enabling the Department of Commerce to establish something like 30 representatives throughout the foreign countries to report on the possibilities of commerce, including information as to port facilities which will be embodied in the data of the Port and Harbor Facilities Commission and be available for any port commission in the United States.

Diverse Control of Port Facilities in This Country

The authorities in charge of port facilities in this country are varied. First come historically the private owners; next the development by local authorities; next come the steamboat and steamship companies which acquired their own property. Probably next in order come the railroads, which provided such facilities as seemed necessary to handle the traffic of the railroads; then the War Department and the Navy Department, each developing to a certain extent its own facilities, especially during the last year. In addition to any facilities on land, the War Department has had charge of the deepening of channels, while the Department of Commerce is responsible for the safeguarding of the harbor lights, lighthouses, etc.

In all of this there is not definite co-operation between the different authorities responsible for the port facilities. In some cases one railroad has built against another railroad; at other ports the municipality has built in competition with the railroads and in competition with private owners. In some cases steamship companies have developed their facilities independent of any other development in the same locality, while private owners, for personal profit, have built piers, warehouses and coaling facilities.

The result of this has been in many cases excessive prices; in others, unnecessary duplication of facilities, so that it has seemed clear to the Port and Harbor Facilities Commission that there should be at each port a single controlling head authorized to operate the facilities as a whole to the best advantage of the commerce of the port and of the country.

Freight Congestion a Reflection of Terminal Deficiencies

I suppose as long as any of us live we shall remember the freight congestion of 1917-18, resulting partly from the enormous tonnage shipped overseas and partly from the

*Address delivered before the Mississippi Valley Foreign Trade Convention at New Orleans, La.

extraordinary weather conditions. Nothing paralyzes transportation operations, whether by rail or water, as congestion. And the congestion was not only on this side. Through lack of facilities, ships carrying munitions and supplies to the Allies were held up at French ports, not simply for days and weeks, but sometimes for months, because the facilities for unloading were inadequate.

The war is practically over, but the quick turn-around of a vessel, reduction of lay days, and the cutting off of demurrage are among the essentials of successful foreign commerce. These reforms must be brought about by unified action, and recognizing this the Railroad Administration has for the last year been carrying out the policy of unifying terminals, placing at every important terminal and port one official in charge of the entire zone. This may appear to be in opposition to the former policy of railroad corporations. It is, therefore, interesting to note that the committee, of which S. Davies Warfield is chairman, and which is said to represent a very large number of security holders, has already publicly endorsed unification of terminals. The Interstate Commerce Commission has recommended the continuance of this policy. Many railroad officials concur in this view, and . . . finally, the committee of Railway Executives, in the plan submitted by its chairman to the Senate committee within the last week, has provided for a Secretary of Transportation, one of whose specific duties shall be to harmonize any differences arising between the railroads using the same terminals.

Therefore, I think it can be safely said for the first time in the history of transportation in the United States, that the national and corporation interests and the state and municipal authorities have united in the thought that all terminals must be unified and must be made common between all parties, and it necessarily follows that this should include not only the tracks and warehouses property of the railroad companies, but particularly as to the ports of the United States, should apply to all facilities of whatever character necessary in the handling of foreign and domestic traffic within and through the port terminal zone.

The Local Port Commission and Its Duties

Not only is it necessary that these port facilities shall be unified and operated on the most economical basis possible consistent with efficiency, but it is also necessary to advertise these conditions and to notify the manufacturers and shippers of the United States, and the manufacturers and shippers of foreign countries with which we deal.

It has not always been easy for a man located directly at a port to understand the conditions, and it is infinitely more difficult for a man located 500 or 1,000 miles in the interior to keep track of the conditions, not merely of one port, but of several possible ports through which he may undertake to forward his traffic. It is for that reason that the Port and Harbor Facilities Commission has strongly advocated through the press and by correspondence the formation in every port of a local port commission to be made up of representatives of not only the transportation interests, rail and water, but also state and municipal authorities, banks, and of the commercial organizations of that particular port.

It is particularly necessary that on such a commission there shall be responsible representatives of the banking interests, who will naturally solicit the accounts of those engaged in export and import traffic by making a specialty of handling the documents of those corporations and individuals so engaged.

The local port commission should be the medium through which advice as to conditions at that port shall be given to the country. In such advertising there should be sufficient detail so that the foreign producer or buyer will have some idea of the relative advantages of the different ports and, of course, the same information should be given to the domestic manufacturer and shipper.

Correspondence with over 1,000 manufacturers of the United States has shown that these may be divided into several classes:

(1) Those who have been engaged in foreign trade so long and are so well posted that they are the ones to give us information rather than for us to give them information.

(2) Those who depend upon export agents, associations or commission houses to make all necessary arrangements, including methods of packing, and for information as to all those details which a single manufacturer could not perhaps afford to enter into until his trade has grown to greater volume.

(3) Those who sell outright and ship to a port without any clear idea as to whether their product is to go abroad or not.

There must, therefore, be a constant growth from Class 3 to Class 2 and Class 1, and further study by the commission shows that there is a tendency for export traffic to move through those ports which are best equipped with responsible export agents or commission houses. Such organizations relieve the shipper and manufacturer from the burden of many details, and, in my opinion, it is necessary for any port which expects to be successful to see that these organizations are encouraged, so that at each port, and especially at each of the Gulf ports, there will be a medium developed through which information regarding the possibility of shipping through that port will be made known to the interior manufacturer.

The local port commission should assume the responsibility of supervising the handling of freight through the port of which it is in charge. If a shipper sends his business through a certain port, which we will designate Port A, and finds that complaints are received alleging damage to packages and he is told that the tackle is old-fashioned and so inadequate that in spite of his best efforts his goods arrive at destination in bad condition, he will no longer patronize that port because, in spite of the fact that in some cases the charges may be lower, the annoyance of his correspondence and the dissatisfaction of his customers will more than counteract this charge.

Informative Work By Commissions Important

The possibility of working out through such a local port commission the necessary details for the development of foreign commerce can hardly be conceived until it is investigated.

I saw the other day a map of Persia. At this particular time trade with Persia is curtailed, but sooner or later the War Trade Board will release these restrictions, and it will be possible to trade freely with Damascus, which is a terminal point for overland caravans bringing from Bagdad rugs, figs, dates, tobaccos and other articles of American import and luxury.

This map of Persia was on a scale of probably 25 miles to the inch, and is in such detail that by studying the symbols one may get all of the information, and more, too, than I shall now enumerate. In the first place, there is a symbol for a steam railroad; another for tramways. Another shows important highways available for every kind of vehicle and beast of burden; another the highways not suitable for vehicles, but which can be used by beast of burden, while still another shows highways that can be used by oxen, mules and horses, but not by camels. Another direction shows that certain highways cannot be used by camels by day because of the stifling heat, but can be used by camels by night. All this information has been worked out in detail for the benefit of the merchant intending to trade with Persia, and I need not tell you that it was prepared in Berlin.

Now, if the Gulf ports will work out the data with the same detail with which Berlin prepared this map of Persia, and will put the information in the hands of every manufacturer of this country, and in every foreign country with which the United States expects to do business, there will be such a distribution of reliable information as has never been equaled before in the history of the commercial business of the United States.

General News Department

Canadian control of railroads in this country is the subject of a report by the Interstate Commerce Commission, made in response to a Senate resolution asking for information as to present or prospective ownership, etc. The Commission has examined the facts regarding the ownership or control of the lines in question: (a) some short subsidiaries of the Canadian Northern operated by the Canadian National Railways and (b) the lines of the Canadian Pacific and the Grand Trunk which are operated by the United States Railroad Administration. The report says it does not appear that there is any present or prospective ownership or control by the Canadian government of any lines in the United States other than those included in the systems named.

Chairman Good, of the House Committee on Appropriations, in discussing the estimates submitted by the Secretary of the Treasury for the expenses of the government during the fiscal year ending June 30, 1921, stated that no estimate for the Railroad Administration had been included because on the date of the report the Railroad Administration was unable to make an estimate; the sums that will be required are almost entirely dependent upon Congressional action in connection with the return of the railroads to their owners' control. Aside from the question of guaranteeing a return to the railroads after they have been restored, there will remain enormous obligations of the government to pay the deficit; but the amount of these depends on the settlements which the Railroad Administration may be able to make in the disposition of cars and engines bought by the government and in the collection of advances already made to railroad companies.

The accident near Parkersburg, W. Va., on August 14, last, when 12 passengers in a street car were killed, has been made the subject of a special report by the Interstate Commerce Commission. This report, dated October 13, is signed by W. P. Borland, chief of the Bureau of Safety. The accident was briefly noted in the *Railway Age* of October 10, page 750. The electric car, a high speed interurban, ran into a switching engine of the Baltimore & Ohio, at a crossing of an industry track, and was wrecked. The locomotive was hidden from the oncoming street car by a building. It had just started from a standstill and had moved but a few feet; and the conductor and a brakeman were in front of the engine and should have given stop signals to the street car; but the investigator finds that they were inattentive to their duty, and did not notice the street car until it got within about 150 ft. of the crossing. The street car, however, was running too fast. It appears that there are no specific printed regulations at this crossing, but trainmen had been specially instructed in the trainmaster's office in regard to it, and the conductor of the switching train was responsible for the safe movement of his engine over the crossing. Street cars do not make a regular stop for the crossing. The locomotive was moving very slowly. The conductor was making his first trip on this job as conductor, though he had served as flagman and was thoroughly acquainted with the conditions.

New England Governors and Business Men

The six governors of the six New England States met in Boston on December 10 to consider transportation and fuel problems; and they adopted resolutions urging that financial assistance be given to the New England railroads by the Federal Government after their return to private control, and that the United States Shipping Board be requested to "allocate some of its large ships to New England owners, operators and managers of steamers." Representatives of the New England railroads and business interests were present at the conference. To return the roads to private control without legislation to restore former conditions "would be disastrous to New England industries, institutions and investors," said the resolution. Financial assistance to New England railroads was requested so as to provide "for the payment of the government guarantee until rates have been put in effect by the Interstate Commerce Commission which shall restore the pre-war relationship of rates between New England and other rate districts, with such increased divisions and allowances as shall assure to the New England roads sufficient revenue properly to serve the New England public without undue increase in intra-New England rates. . . ."

The resolution recited that "owing to increases in expenses the New England roads have been more severely affected than roads in any other section of the country; they cannot under rates now in effect render sufficient service to the public; their working capital has been depleted and they are substantially without credit."

Edward G. Buckland, president of the New York, New Haven & Hartford, presented a statement showing that the railroads in New England during the three years prior to the war averaged a combined net income totalling $38,883,011, during the twenty-two months of government operation net income was reduced to $10,612,375, and in place of a surplus of $10,511,828 there was a deficit of $19,968,991.

The roads in this district, he said, had earned during the period of government control 29.9 per cent of the government guarantee, whereas roads in other sections had earned between 75 and 76 per cent. The relatively poor showing, he explained, was due to increased costs of carrying coal, terminal charges that were excessive because of peculiar geographical conditions and wage advances that had been particularly severe on the New England roads because in this section pre-war wages were below the average.

Machinery for Disposing of Administration Business

A discussion as to the kind of organization that would be necessary to dispose of unfinished business at the time of the return of the railroads to private control was started at the recent annual meeting of the National Industrial Traffic League at Chicago. After some consideration of the subject it was agreed that O. W. T. Tong, traffic manager and secretary of the Northern Potato Traffic Association, Minneapolis, Minn., who started the discussion, should communicate his views to the executive committee of the league in order that some definite agreement as to the league's stand on this subject might be taken. In compliance with this arrangement, Mr. Tong in a letter to H. C. Barlow, chairman of the league's executive committee said in part:

"The bills now before Congress appear to make adequate provision for the preservation of shippers' rights in all matters that may remain unadjusted on the date of return to private control. These bills, however, do not furnish the necessary machinery to carry out the legal intent, and it is, therefore, important for the National Industrial Traffic League to aid in getting the necessary organization to protect the shippers' rights in their future dealings with the government.

"It is not difficult to foresee disastrous times ahead for shippers if they do not now act intelligently in arranging for an organization subsequent to return to private control. There will be, for instance, many overcharge, loss and damage and reparation claims which will be unadjusted, and there must, necessarily, be an organization which will be competent, efficient and duly authorized to dispose of these unadjusted matters in a manner satisfactory to parties interested. Furthermore, it is altogether probable that the Interstate Commerce Commission will issue, after January 1, 1920, many

reparation orders directed to the Railroad Administration.

"When the Railroad Administration was created there was a great deal of unadjusted private control business, and the employees, who then became employees for the government, were allowed to proceed to dispose of this private control business the same as though the carriers had not been taken over. It would be natural, of course, upon return to private control, to have all the carriers continue to handle the business of the government and dispose of it the same as though there were no change in the management, but it is my view this would, in all probability, not work out satisfactorily unless safeguarded, as I doubt very much whether, after the expiration of from three to six months, the carriers would take the same interest in disposing of government affairs as they formerly took in disposing of the corporation affairs after they were on the government payrolls. This is not said in a spirit of criticism. It would be natural for the carriers to attend to their own affairs first, after return to private control, and this outstanding government business would then be given secondary consideration, whereas the affairs will be important and should be efficiently and promptly handled.

"In my view, arrangements should be made to continue in office, for the disposition of government business, all treasurers of the railroads who may, after return to private control, be appointed as treasurers of the corporations. They should act in the dual capacity of treasurer for the government and for the corporation. In the same manner, all other officers of the corporations, after return to private control, should act in the dual capacity of officers for both the corporation and the government. In addition thereto, every effort should be made to retain the present officers of the Railroad Administration, such as Hon. Max Thelen, Mr. Edward Chambers, Hon. Chas. A. Prouty, and the others who are at the head of the various departments at Washington, they to be given such authority as to retain on the government payrolls the necessary employees. Provision should also be made to insure government employees' obedience to every request or order from such government departments.

"The preferable way, of course, is to retain the present Railroad Administration at Washington, with full power to dispose of the unfinished business, but my fear is that many of these officers will desire to leave the service immediately upon return of carriers to private control, and if this is done it is imperative that exceedingly good judgment be used in selecting successors. This will be difficult on account of the natural inclination to reject positions with dead and obsolete departments, particularly as the departments will handle business which will be, to say the least, very uninteresting and with no particular incentive to be wholly efficient."

National Chamber Urges Rule of Rate-Making

Unless the public in the regulation of railroads adopts a policy that will enable the private corporations to meet their expenses and to secure necessary capital, corporate operation will fail, and the government will have to resume the burden of operating and probably of owning the railroads, according to a statement by the special committee appointed by the board of directors of the Chamber of Commerce of the United States to make effective the results of the national chamber's referendum No. 28 on needed railroad legislation.

Elliot H. Goodwin, general secretary of the chamber, in a letter advising officers of local chambers of the views of the special committee, says that the time has come for the business men of the country to urge their representatives in Congress to include in the railroad legislation about to be enacted a rule of rate making designed to yield sufficient revenue to enable the railroads to furnish the service that is required by the public.

Mr. Goodwin calls attention to the referendum taken last summer which declared almost unanimously in favor of a rule of rate-making. The Cummins railroad bill, now being considered in the Senate, includes such a rule. The Esch bill originally included a rule of rate making, and the House committee on interstate and foreign commerce recommended it; but when the House took the measure up for consideration the rule was stricken out.

"All commercial organizations that stand for the rule of rate making—all business men who believe in it—should immediately communicate their views to their senators and representatives and urge them to do all in their power to have this principle incorporated in the law that will provide for the regulation of the railroads after they are returned to private operation," General Secretary Goodwin says. Reasons why the rule of rate-making should be adopted, prepared by the special committee, are attached to Secretary Goodwin's letter.

"It is generally recognized," the committee points out, "that when the railroads were taken over by the government their revenues were not sufficient to enable them to supply the country with adequate transportation facilities and to furnish the services needed by the public. During the period of government operation the financial burden of maintaining transportation has been borne by the government, which has drawn part of the funds necessary for maintaining the roads from the Treasury of the United States.

"The railroads are soon to be returned to their owners, who must necessarily incur large expenditures for postponed construction and for deferred maintenance.

"It is clear that the revenues of the railroads in the future must be greater than in the past, both because extraordinary capital expenditures must be made and because current expenses, due to increased wages and higher costs of materials and supplies, will be much larger than they have been in the past. Unless the public in the regulation of railroads adopts a policy that will enable the private corporations to meet their expenses and to secure necessary capital, corporate operation will fail and the government will have to resume the burden of operating and probably of owning the railroads.

"A choice must be made of one of three courses of action; (1) the statutory power and responsibilities of the Interstate Commerce Commission as regards the rates and revenues of the carriers may be left unchanged and reliance be placed upon the commission to adopt and adhere to a policy of rate regulation that will cause the carriers to obtain the income needed to provide the transportation facilities and services necessary for the public; (2) the government may guarantee a definite minimum return upon capital now devoted to railroad transportation or hereafter invested therein; or (3) Congress may adopt a statutory rule to be observed by the Interstate Commerce Commission in regulating, adjusting, and prescribing rates and fares.

"To adopt the first of these three policies and to enact no legislation to make railroad revenues more definite and the credit of the railroads more stable would be to invite financial disaster on the part of a large share of the railroads and to make probable the failure of corporate ownership and operation. Public regulation would defeat its own object and would start the country upon the fatuous course of government ownership and operation.

"The objections to a guarantee by the government of a minimum return to each railroad company either upon its capitalization or upon the property devoted to the public service are definite and conclusive. As the Railroad Committee of the Chamber of Commerce of the United States stated in the report which accompanied Referendum 26, 'a government guarantee would tend to lessen initiative and cause both the prosperous and the unprosperous roads to feel less responsibility for efficient management.'

"The reasons in favor of the adoption by Congress of a statutory rule of rate-making are as convincing as are the arguments against either no action by Congress or the adoption of the policy of government guarantee of the return upon the capital of the railroad companies. Such a rule would give the Interstate Commerce Commission definite guidance. It would establish a form of rates and revenues which the commission, the carriers, the shippers, and the public could recognize as determining their obligations and rights. It would not be a government guarantee because the government would assume no financial responsibility. It would not lessen initiative on the part of the carriers because it would not take away from them the incentives to improvements in economy and efficiency of service."

Commission and Court News

Court News

Refusal to Carry on Wrongly Routed Ticket

A passenger bought a ticket at Columbia, S. C., for Florence, between which places there are two routes. She specified the route she wished, but the conductor subsequently refused the ticket because it was not so routed. In an action for actual and punitive damages, the South Carolina Supreme Court held that the testimony was not at all suggestive of the willful conduct of the conductor, but merely of negligence of the ticket seller, for which the plaintiff was compensated by a verdict for actual damages, assessed by the jury at $2.20.—Penn v. Atlantic Coast Line (S. Car.) 98 S. E. 793.

Damages for Refusal to Accept Mileage Book

A conductor refused to accept a mileage book coupon, thinking the book was not good on that road, and demanded the cash fare—15 cents—which was paid. He discovered his mistake the same day, and next day, when the passenger tendered the same book, he accepted the coupon, acknowledged his mistake, and tendered three cents—the difference between the cash fare paid and the value of the coupon. The passenger declined the offer and sued the railroad for $100 damages. The South Carolina Supreme Court affirmed a judgment for three cents, as the actual damage sustained, holding that the circumstances did not warrant the finding of punitive damages.—Schirmer v. Charleston & Western Carolina (S. Car.) 98 S. E. 134.

Construction of Uniform Bill of Lading

An action to recover damages for the loss of merchandise delivered to the Erie Railroad for transportation from Passaic, N. J., to New York City involved the proper construction of Uniform Bill of Lading, section 5, providing that property when received from private or other sidings, etc., shall be at owner's risk until cars are attached to trains. The merchandise had been loaded by the consignors on a car placed on a track laid by the railroad on its own land for the use and convenience only of shippers whose warehouses were adjacent thereto. The New York Court of Appeals holds that the track was a "private or other" siding within the bill of lading, the words "or other" following the word "private" include not *all* sidings, but only sidings *like* private sidings, such as this.—Bers v. Erie (N. Y.) 122 N. E. 456.

Modification of Freight Rate Contracts

The Pennsylvania Supreme Court holds that equity will not restrain a railroad from charging a higher rate than that fixed by a contract made in consideration of the grant of a right of way over a shipper's land, though made prior to 1913, where the railroad is charging regular rates fixed by the Public Service Commission. The shipper's remedy is by application to the commission for a reduction of rates under the act of 1913. It would be impossible for the commission to enforce an equality of reasonable rates, except upon the basis that it is not bound by contracts previously entered into between a public service company and either a municipality, another corporation or a private individual. A party entering into a contract with a railroad relating to rates is presumed to do so with knowledge that the state's right to exercise its police power is expressly reserved, and that, if public interest demands, its provisions may be modified without violating the provision of the Constitution of the United tates forbidding impairment of the obligation of contracts.—Teiper v. Baltimore & Philadelphia (Pa.) 105 Atl. 551.

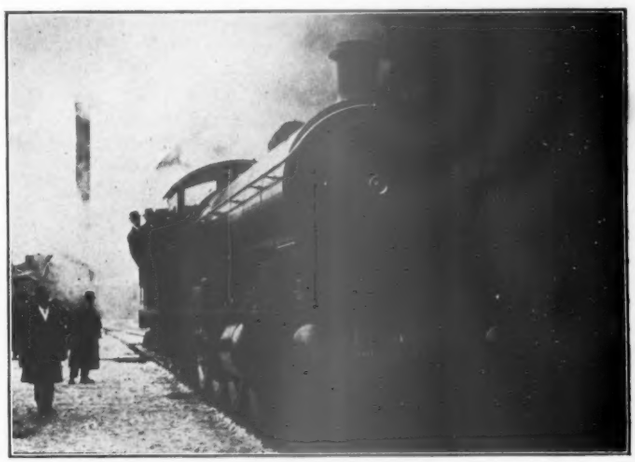
Foreign Railway News

Armstrong Whitworth's Locomotive Shops

LONDON.

On November 12, one year after the signing of the Armistice, Sir W. G. Armstrong, Whitworth & Co., Ltd., celebrated the conversion of its shell works at Scotswood to a locomotive manufacturing plant, by the official steaming and trial of the first locomotive completed at these works. This engine is a freight engine of the 0-8-0 type and is the first of an order of 50 for the North Eastern Railway.

In view of the extreme difficulties of obtaining suitable equipment immediately after the signing of the Armistice, the change from war work to that of locomotive building was exceptionally interesting. These shops are designed to produce from 300 to 400 locomotives a year, and the erecting shops have a capacity of 50 locomotives without tenders.



The First Locomotive Built at the Former Shell Works of Armstrong-Whitworth, at Its Trial at Newcastle, November 12

The management of the shops is in charge of R. B. McColl, who was for 15 years with the American Locomotive Company at Montreal, and who came to England at the beginning of this year from a one year's engagement with the Baldwin Locomotive Works of Eddystone. Under his direction a well laid out plant has been built, which is undoubtedly the most up-to-date locomotive building plant in England. Orders have already been received for locomotives for India, which will be built at this plant.

The official opening ceremony at the works was presided over by Sir Vincent L. Raven, chief mechanical engineer of the North Eastern Railway. At a banquet given in the evenning Mr. Faulkner, chairman of the Armstrong, Whitworth Company presided and mentioned the fact that this was the third attempt of this company in the manufacture of locomotives since 1849. He stated that this plant will be in a position to manufacture electric locomotives shortly.

RAILROAD DEVELOPMENT AT CHICAGO.—The Illinois Central Railroad Company and the Michigan Central Railroad Company have made a joint application to the Public Utilities Commission of Illinois for an order consenting to the acceptance of an ordinance for the establishment of Harbor District No. 3, the construction by the Illinois Central of a new passenger station at Chicago, the electrification of certain of the lines of the Illinois Central and the Michigan Central within the city of Chicago and development of the Chicago lake front, passed by the Chicago City Council on July 21, 1919.

Equipment and Supplies

Freight Cars

THE NEW YORK CENTRAL is inquiring for 1,000 55-ton hopper cars.

THE ANN ARBOR is inquiring for from 100 to 200 U. S. R. A. standard, single sheathed box cars.

THE DETROIT, TOLEDO & IRONTON is inquiring for 700 U. S. R. A. standard 40-ton double sheathed box cars.

THE BRIAR HILL STEEL COMPANY, Youngstown, Ohio, has ordered 50 gondolas from the Ralston Steel Car Company, Columbus, Ohio.

THE MANHATTAN OIL COMPANY, Minneapolis, Minn., reported in the *Railway Age* of October 24 as being in the market for 200 tank cars, has ordered 100 tank cars from the General American Tank Car Company.

Passenger Cars

THE LONG ISLAND RAILROAD, reported in the *Railway Age* Emergency Bulletin of November 6 as inquiring for 50 trailer cars, 30 steam coaches and 20 motor cars, is negotiating with the American Car & Foundry Company for this equipment. The American Car & Foundry Company, it is reported on reliable authority, will probably build the cars if it decides to accept the proposal of the Long Island by accepting payment in car trust certificates and notes extending over a period of ten years. The American Car & Foundry Company is asking the manufacturers of the material specified for use on the cars to accept their respective shares of the burden; and if they all consent the contract will probably be signed by the end of the month.

Locomotive Deliveries in September

The Railroad Administration has issued the following statement of locomotives shipped for the month of September:

	On order prior to Federal control		USRA Administration orders		Constructed in railroad shops			
Name of road	Type	No.	Type	No.	Type	No.	Total	Builders
A. C. L.		..	USRA Pa.	11		..	11	American
A. T. & S. F.	Santa Fe	1		..		..	1	Baldwin
Ann Arbor		..	USRA S. F.	4		..	4	Baldwin
B. & O.		..	USRA Pac.	6		..	6	American
C. C. & O.		..	USRA Mal.	3		..	3	Baldwin
I. H. B.		..	USRA Mik.	8		..	8	Lima
L. V.	Santa Fe	15		..		..	15	Baldwin
Missouri Pac.		..	USRA Mik.	15		..	15	Lima
N. & W.	Mallet	2	USRA Mal.	4		..	6	Baldwin
P. L. W.	Santa Fe	7	USRA S. F.	4		..	11	Baldwin
P. L. W.	Mallet	1		..		..	1	Baldwin
P. & R.	Mallet	1		..		..	1	Baldwin
S. A. L.		..	USRA S. F.	4		..	4	Baldwin
Sou. Pac.		..		..	Switch	1	1	Southern Pacific
Virginian		..	USRA Mal.	1		..	1	American
W. & L. E.		..	USRA Mal.	6		..	6	Baldwin
P. R. R.		..		..	Decapod	4	4	Penn. R. R.
Total		27		66		5		

THE TRAFFIC CLUB OF CHICAGO held a memorial meeting on December 8, as a tribute of respect to Frank B. Montgomery, formerly president of the Traffic Club and traffic manager of the International Harvester Company, who died on November 24.

THE LAKE TAHOE RAILWAY TRANSPORTATION COMPANY has been authorized by the Railroad Commission of California to issue to the Union Trust Company of San Francisco, Cal., 6 per cent notes aggregating $50,000 to renew notes now held by the latter company.

Supply Trade News

Franklin Schneider, president of the Van Dorn Electric Tool Company, has been elected vice-president of the **Van Dorn & Dutton Company,** Cleveland, Ohio.

George Royal, western railroad representative of the Nathan Manufacturing Company, New York, with office at Chicago, has been appointed railroad representative of **Jenkins Brothers,** Chicago, manufacturers of valves and packings, with the same headquarters.

Fairbanks, Morse & Company are planning to erect a $1,500,000 foundry at Beloit, Wis. The erection of the new plant, which is to be 900 ft. long, 550 ft. wide and will contain 495 sq. ft. of floor space, will be started next spring. The foundry, when completed, will consist of one large building covering 11 acres of ground and including facilities for the storage of flasks, iron, sand, etc. The capacity of the new plant will be approximately 350 to 400 tons of gray iron daily. Plans and specifications for the structure are rapidly nearing completion and the raw material for its construction will be placed on the ground during the winter. Much of the equipment in the foundry will be electrical, the present plans calling for electric cranes, grab buckets, magnets and conveyors.

Trade Publications

OIL BURNING APPLIANCES.—The Aeroil Burner Company, Union Hill, N. J., manufacturers of oil burning appliances, has issued an eight-page bulletin describing their outfits for thawing out frozen cars, pockets, hoppers, pipes, switches, loading gates, chutes, etc. The bulletin is fully illustrated showing the application of the various outfits to the particular work to which they are adaptable.

CONDENSERS, PUMPS AND COOLING TOWERS.—Bulletin No. 112-B revised and enlarged, entitled "Condensers, Pumps, Cooling Towers, Etc." has just been published by the Wheeler Condenser & Engineering Company, Carteret, N. J. This bulletin illustrates the latest developments in condenser practice and shows photographs of a number of actual installations of surface condensers. It illustrates and describes surface condensers, jet condensers, barometric condensers, the Wheeler-Edwards air pump, the Wheeler rotative dry vacuum pump, the Wheeler turbo-air pump, the patented Wheeler steam jet air pump, Wheeler centrifugal pumps for all services, jet condensers, barometric condensers, natural and forced draft cooling towers, feed water heaters, and Wheeler evaporators and dryers.

EDITORIAL

Railway Age

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The Latest in Unification

The operation of the railways of the United States as one unified system has resulted in the very general pooling of the supplies of the individual roads for the common use of all. As a result the relatively large quantities of materials held in stock by the more forehanded roads have been drawn on to replenish the depleted supplies of others, to the interest of the railway supply companies. This practice has been introduced very generally in the mechanical department; it has been followed in the transportation department; the maintenance of way department has not been immune from its influence. More recently this wave has reached the dining car department; the waiters on a dining car on the most important train on one of the leading trunk lines have been observed a few days ago to be wearing jackets bearing the initials of three different roads. Surely, the possibilities of unified operation are great and the limitations are few.

Judge Dickinson's Big Railroad "Salary"

In the issue of the *Railway Age* for October 10, which was printed on November 26, there was given, beginning on page 351, a list of railway salaries paid in 1917 which was published in the Congressional Record of November 18 at the instance of Representative Sims of Tennessee. In this list the name of Jacob M. Dickinson, receiver of the Chicago, Rock Island & Pacific Railway Company, appeared, and it was stated that his salary was $120,732.90. The *Railway Age* has received a letter from Frank Nay, vice-president and comptroller of the Rock Island company, in which he states the correct facts regarding Judge Dickinson's compensation. "In the amount named," says Mr. Nay, "is a special fee granted by the court in July, 1917, amounting to $100,000, which in reality covered the entire period of the receivership from April 19, 1915, to June 24, 1917, inclusive, a period of more than 26 months, or about $3,800 a month. Your remarks give the impression that Mr. Dickinson received about $120,000 a year, which, you will note, is far above the fact." It is probable that if similar explanations were made regarding the amounts stated to have been paid to other railway officers the alleged "fancy salaries" paid would be substantially reduced in many cases.

Place Your Order Now

If labor conditions are still in an unsettled and unsatisfactory state, as now seems probable, at the start of the 1920 construction season and the railroads, through legislation, find themselves in a favorable financial condition to start work on a construction program which will anywhere nearly approach their needs, there will arise the important question of developing means to carry out the work. The logical answer will be the increased utilization of mechanical substitutes for manpower. This would seem to be the proper time for each officer concerned with construction or maintenance to undertake careful studies to determine the character of the work to be done under his direction, in the prosecution of which labor-saving devices are most applicable, and if the proper equipment is available. Each year it is being demonstrated that the field of railway work in which machines may be used economically is enlarging. It is only within recent years that section motor cars have been adopted to any considerable extent, and while many roads already consider them indispensable still each year's experience discloses new uses to which they may be put advantageously. The history of other devices in the long list of labor-saving machines already used by the roads is similar. There never was a time when the need for more extensive use of these substitutes for labor was more urgent. After there is reasonable assurance that the most is being made of existing equipment there remains the question—is the present equipment sufficient to meet the requirements of the emergency which it seems certain will confront the roads in the spring? In many cases the probable answer is "no." If so the opening of the season's work will be marked by a demand for machines beyond the capacity of manufacturing plants to supply on short notice. An analysis of the needs made now followed promptly with orders will ensure more timely deliveries and save much valuable time during the working season.

An Example of War-Time Engineering

No record of the part played by engineers in the recent world conflict is complete without reference to their work in the conduct of purely civil pursuits. In an effort to meet the conditions imposed by the state of war, practices were adopted and measures instituted which might be considered highly questionable under normal circumstances, but which under war conditions represent excellent engineering. In many cases as high a degree of ingenuity was displayed in the design and building of what might be termed makeshift constructions of the war period as in the permanent work of peace times. One excellent illustration of war construction is the new Chamberlain bridge of the Chicago, Milwaukee & St. Paul over the Missouri river, described elsewhere in this issue. At first thought the use of 300 ft. spans on timber piers in a river subject to a shifting bottom and heavy ice floes seems unwarranted, but after a careful study of the circumstances under which the structure was built, as outlined in the introduction of the article referred to, the reasons for adopting this particular design will be readily appreciated. The combination of reinforced concrete with timber is unique, but, with respect to this also, careful analysis will disclose that there were excellent reasons for adopting its use. It is not alone in expensive permanent construction that the design is afforded opportunities to evince his technical knowledge and ingenuity. The limitations placed on construction by war conditions served to foster skillful engineering rather than to suppress it.